Game 1

D-017083

Game 1 - Mid Stage 1

Basic Description: Game 1 represents conditions that would be in place mid Stage 1. JPOD, Delta island storage, groundwater banks would be available.

Beginning Assets:

- $30 million annual fund for water purchases.
  - NOD (100 TAF)
  - SOD (100 TAF)
  - spot market (200 TAF)
- Ground Water Banks
  - Semitropic (200 TAF of storage space available with 20 TAF/mo in and 10 TAF/mo out limits)
  - Kern (300 TAF of storage space available with 20 TAF/mo in and 10 TAF/mo out limits)
  - Gravelly Ford (100 TAF of storage space available with 20 TAF/mo in and 10 TAF/mo out limits)
- Expanded Shasta (145 TAF per year if reservoir fills)
- Debt carrying ability in project reservoirs (primarily San Luis and Shasta)
- Delta Islands evapotranspiration savings to EWA (30 TAF/year)
- Delta Island storage connected to CCF (120 TAF, 60 TAF in or out per month limitation)

Asset Generating Capability:

- Relaxation of Export/Inflow standards
- Export water to San Luis or groundwater banks when projects were not at capacity.

Baseline Conditions: Accord + AFRP, JPOD

- 1995 demand level
- 8500 cfs expanded capacity for Banks pumping plant
- Delta island storage is screened, while Banks and Tracy are not.
- 120 TAF of Delta storage for projects (60 TAF in/out limit per month)

Actions Taken:

- Relaxed E/I standard in dry and wet years to export water into EWA account in San Luis reservoir and groundwater banks.
- Limited project exports in winter and spring to reduce fish being drawn to pumping plants.
- Pumped water to Delta Island storage for EWA.
- Pumped water EWA accounts in San Luis and groundwater Banks when excess capacity allowed.
- Pumped project water through Delta Island intakes to take advantage of state-of-the-art screens.
- Backed up water into Shasta EWA account when possible coincident with export reductions.
- Purchased water from Yuba for release to rivers and Delta, and payment of debt in San Luis.
- Closed HOR and DCC as necessary.

Water Operations Summary: Gaming Exercise

Scenario #:1A			Target Year: 4
Possible Water Supply Measures	Details	EWA/ Users Division	How to Model How to Game
Interim South Delta Program - 8.5 kcfs	8.5 kcfs	Users below E/I EWA above E/I	Operate as reduced Project constraints. EWA gets water through contract (see below)
JPOD. No individual State/ Federal sublimits	No state or federal sublimits apply	Projects below E/I. EWA above E/I	Operate as reduced Project constraints. EWA gets water through contract (see below)
Allow E/I variances			EWA authority to propose variences. In keeping with desire to maximize EWA assets, bias should be toward variences.
Allow in-Delta AFRP variences			Decision of DNCT to propose variences. In keeping with desire to maximize EWA assets, bias should be toward variences
Kern Water Bank	300 kaf storage. 20 kaf/month in. 10 kaf/month out.	EWA	Do not model. Operate by hand in game.
Gravelly Ford Groundwater	200 kaf storage? 20 kaf/month in. 10 kaf/month out.	Projects/ EWA split	Operate Project share in model. Operate EWA share by hand.
Shasta Dam Expansion	290 kaf storage	Projects/ EWA split	Operate Project share in model. Operate EWA share by hand.

Possible Water Supply Measures	Details	EWA/ Users Division	How to Model How to Game
Delta Island Storage	240 kaf storage. 120 kaf *2 islands	Projects/ EWA split	One island controlled by Projects. Model according to Delta Wetlands rules. One island controlled by EWA and connected to Clifton Court via a 2 way 2 kcfs pipe. Can fill from Clifton Court at 2 kcfs using unused Project rights, plus 2 kcfs when Delta out of balance. Operate EWA share by hand.
ET reductions on Delta storage islands	30 kaf/year average	Projects/ EWA split	Operate by hand in game.
Semitropic high priority storage	200 kaf storage	EWA	Operate by hand in game
SOD water purchase options	100 kaf. Usable 3X every 10 years	EWA	Operate by hand in game
NOD water purchase options	100 kaf. Usable every year.	EWA	Operate by hand in game
Spot Purchases	Max of 200 kaf per year. Limited by EWA funds.	EWA	Operate by hand in game
Demand shifting	100 kaf. Short term storage lease in San Luis.	EWA	Operate by hand in game
Access Surplus Capacity		EWA	Operate by hand in game
Urban efficiency purchase	15 kaf/yr from 500 ktoilet replacements	EWA	Operate by hand in game

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Initial Conditions

Assume that:

- o All EWA storage is 50% full at the beginning of the game.
- o EWA is funded at the initial level only (e.g., $30 million)

EWA Fiscal Budget

All capital costs (e.g., facilities) and recurring costs (e.g., routine option costs) are outside the game. Discretionary expenditures will be dealt with within the game. Discretionary expenditures are: (1) cost of deposits and withdrawals from storage; (2) cost to call options; (3) cost to purchase water on the spot market. Related expenditures such as conveyance cost and power costs will not be dealt with yet. EWA may build up its fiscal reserves by selling or leasing its rights to water or facilities.

Assumed prices:

All purchases	$100/af
Sales by EWA	$100/af
Kern Water Bank deposit	?
Kern Water Bank withdrawal	?
Semitropic deposit	?
Semitropic withdrawal	?
MWD delivery shift	
fast payback	$100/af
delayed payback	$1000/af

EWA budget for purchases: $30 million initial + $30 million per year. Unused expenditures may be accumulated for use in later years. (This number was derived using some basic assumptions about costs and the frequency of use for various options).

Modeling Basis

Modeling will be based upon a combination of pre existing policy, new prescriptive rules from the bio team (no such changes are

assumed), new facilities, new actions, etc. Based upon the matrix above, the modeling upon which the game would be founded would be run with the following assumptions:

- o 1995 Level of Development?
- o Accord + VAMP
- o All AFRP
- o Trinity
- o Interim South Delta Improvements (8.5 kcfs)
- o Unlimited JPOD
- o New in-Delta storage (120 kaf)
- o Gravelly Ford storage (100 kaf)
- o Enlarged Shasta (145 kaf)

Water Supply Evaluation

The results from the modeling basis will roughly represent actual estimated Project deliveries.

Game Rules

- o EWA has the right to carry debt and to use Project facilities, provided it can assure no harm, unless arrangements for compensation are agreed to in advance. Thus, the EWA may borrow against future water supplies, may shift Project storage from upstream storage to downstream storage, etc., provided that it can make the Project's whole with high probability.
- o Unless otherwise specified, EWA has the low priority access to Project facilities.
- o EWA receives its annual income at the beginning of each water year. EWA may borrow up to one year of future income (e.g., an additional $30 million) at an interest rate of 8% per year.

Shifting to Other Target Years

A shift from Target Year 4 to earlier years will result in the loss of Shasta storage, Gravelly Ford storage, and Delta island storage. Additional purchases might be incorporated to compensate, if deemed feasible.

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A shift from Target Year 4 to later years might result in the inclusion of the full South Delta Program (10.3 kcfs), additional efficiency and reclamation purchases, additional groundwater storage projects, and (over time) additional surface storage projects.

GAME 1	Water Year	1991	Values in italics are calculated										
	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*30*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases		0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River Market Releases		0	0	0	0	0	0	0	0	0	0	0	0
Delta Cross Channel Closed?													
Bacon Island Diversions		0	0	0	0	0	60	0	0	0	0	0	0
Pumping from/to Bacon to/from CCFB		*60*	*0*	*0*	*0*	*0*	*60*	*0*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions		0	0	0	0	0	0	0	0	0	0	0	0
Diversion to Island		0	0	0	0	0	0	0	0	0	0	0	0
Release for export		0	0	0	0	0	0	0	0	0	0	0	0
Change in CCFB/Tracy Diversions		*0*	*30*	*50*	*0*	*0*	*-150*	*-60*	*0*	*0*	*0*	*0*	*0*
Total Change in Delta Diversions		*0*	*30*	*50*	*0*	*0*	*-90*	*-60*	*0*	*0*	*0*	*0*	*0*
Divert for EWA from Store/buy, surplus				24									
E/I relaxation			30	26									
Carriage Water		0	0	6	0	0	0	0	0	0	0	0	0
Change in Delta Outflow		*0*	*-30*	*-20*	*0*	*0*	*90*	*60*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"		0	0	0	0	0	0	0	0	0	0	0	0
MWD Shift Water to/from EWA		0	0	0	0	0	0	0	0	0	0	0	0
Efficiency/ET		2	2	2	2	2	2	3	3	3	3	3	3
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*-20*	*-20*	*-20*	*-20*	*-20*	*-10*
Change in San Luis Storage		*62*	*32*	*52*	*2*	*2*	*-88*	*-37*	*23*	*23*	*23*	*23*	*13*

End of Month Values for EWA Accounts

	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		70	70	70	40	40	40	40	40	40	40	40	40	40
Delta Storage		60	0	0	0	0	0	0	0	0	0	0	0	0
SemiTropic	200	100	100	100	100	100	100	100	90	80	70	60	50	40
Kern	100	150	150	150	150	150	150	150	150	150	150	150	150	150
Gravelly Ford	100	50	50	50	50	50	50	50	40	30	20	10	0	0
Borrowed San Luis		0	62	94	146	148	150	62	25	48	71	94	117	130
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0	0
Purchased	$/af													
Spot Sacramento	200		0	0	0	0	0	0	0	0	0	0	0	0
Option Sacramento	100		0	0	0	0	0	0	0	0	0	0	0	0
Spot San Joaquin	200		0	0	0	0	0	0	0	0	0	0	0	0
Option San Joaquin	100		0	0	0	0	0	0	0	0	0	0	0	0
Spot export area	200		0	0	0	0	0	0	0	0	0	0	0	0
Option export area	100		0	0	0	0	0	0	0	0	0	0	0	0
Purchased but undelivered														
Sacramento		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Purchases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*3*	*3*	*3*	*3*	*3*	*2*
Payments to EWA			30											
Financial Balance		*0*	*30*	*30*	*30*	*30*	*30*	*30*	*27*	*24*	*21*	*18*	*15*	*13*

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GAME 1	Water Y 1992	Values in italics are calculated											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*20*	*20*	*0*
Sacramento River Market Releases		0	0	0	0	0	0	0	0	0	30	30	0
San Joaquin River Market Releases		0	0	0	0	0	0	42	0	0	0	0	0
Delta Cross Channel Closed?						y							
Bacon Island Diversions		0	0	0	0	0	0	105	0	0	0	0	0
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*0*	*0*	*105*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island		0	0	0	0	60	60	0	0	0	0	0	0
Release for export		0	0	0	0	0	0	0	0	0	120	0	0
Change in CCFB/Tracy Diversions		*0*	*0*	*0*	*0*	*-80*	*-180*	*-105*	*0*	*0*	*160*	*40*	*0*
Total Change in Delta Diversions		*0*	*0*	*0*	*0*	*-20*	*-120*	*0*	*0*	*0*	*160*	*40*	*0*
Divert for EWA from Store/buy, surplus											40	40	
E/I relaxation						60							
Carriage Water		0	0	0	0	0	0	0	0	0	10	10	0
Change in Delta Outflow		*0*	*0*	*0*	*0*	*20*	*120*	*42*	*0*	*0*	*10*	*10*	*0*
South of Delta market "deliveries"		0	0	0	0	0	0	20	20	20	20	20	0
MWD Shift Water to/from EWA		0	0	0	0	0	0	0	0	0	0	0	0
Efficiency/ET		2	2	2	2	2	2	3	3	3	3	3	3
Change Groundwater Storage		*-10*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*12*	*2*	*2*	*2*	*-78*	*-178*	*23*	*23*	*23*	*63*	*63*	*3*

End of Month Values for EWA Accounts

	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		40	40	40	40	40	40	40	40	40	20	0	0
Delta Storage		0	0	0	0	0	0	0	0	0	0	0	0
SemiTropic	200	30	30	30	30	30	30	30	30	30	30	30	30
Kern	100	150	150	150	150	150	150	150	150	150	150	150	150
Gravelly Ford	100	0	0	0	0	0	0	0	0	0	0	0	0
Borrowed San Luis		142	144	146	148	70	-108	-85	-62	-39	24	87	90
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Purchased	$/af												
Spot Sacramento	200	0	0	0	0	0	0	0	0	0	0	0	0
Option Sacramento	100	0	0	0	0	0	100	0	0	0	0	0	0
Spot San Joaquin	200	0	0	0	0	0	0	42	0	0	0	0	0
Option San Joaquin	100	0	0	0	0	0	0	0	0	0	0	0	0
Spot export area	200	0	0	0	0	0	0	0	0	0	0	0	0
Option export area	100	0	0	0	0	0	100	0	0	0	0	0	0
Purchased but undelivered													
Sacramento		*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*70*	*40*	*40*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*100*	*80*	*60*	*40*	*20*	*0*	*0*
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*20*	*8.4*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		30											
Financial Balance		*41*	*41*	*41*	*41*	*41*	*21*	*12.6*	*12.6*	*12.6*	*12.6*	*12.6*	*12.6*

GAME 1	Water Y 1993	Values in italics are calculated											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*-145*	*0*	*0*	*0*	*97*	*0*	*48*
Sacramento River Market Releases		12	12	0	0	0	0	0	0	0	0	0	0
San Joaquin River Market Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Delta Cross Channel Closed?													
Bacon Island Diversions		0	0	0	120	120	80	28	0	40	0	0	0
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*60*	*120*	*60*	*108*	*0*	*0*	*40*	*0*	*0*
Webb Tract Diversions													
Diversion to Island		0	0	0	90	30	0	0	0	0	0	0	0
Release for export		0	0	0	0	0	0	0	0	0	120	0	0
Change in CCFB/Tracy Diversions		*10*	*10*	*50*	*-210*	*-230*	*70*	*-126*	*-140*	*0*	*197*	*0*	*40*
Total Change in Delta Diversions		*10*	*10*	*50*	*0*	*-80*	*150*	*-98*	*-140*	*40*	*197*	*0*	*40*
Divert for EWA from Store/buy, surplus		10	10								77		40
E/I relaxation				90			150			40			
Carriage Water		2	2	0	0	0	0	0	0	0	20	0	8
Change in Delta Outflow		*2*	*2*	*-50*	*0*	*80*	*-295*	*98*	*140*	*-40*	*20*	*0*	*8*
South of Delta market "deliveries"		0	0	0	0	0	0	0	20	20	20	20	20
MWD Shift Water to/from EWA		0	0	0	0	0	0	0	0	0	0	0	0
Efficiency/ET		2	2	2	2	2	2	3	3	3	3	3	3
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*60*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*12*	*12*	*52*	*-148*	*-108*	*72*	*-15*	*-117*	*23*	*140*	*23*	*63*

End of Month Values for EWA Accounts

	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		0	0	0	0	0	145	145	145	145	48	48	0
Delta Storage		0	0	0	60	60	80	0	0	40	0	0	0
SemiTropic	200	30	30	30	30	30	50	50	50	50	50	50	50
Kern	100	150	150	150	150	150	170	170	170	170	170	170	170
Gravelly Ford	100	0	0	0	0	0	20	20	20	20	20	20	20
Borrowed San Luis		102	114	166	18	-90	-18	-33	-150	-127	13	36	99
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Purchased	$/af												
Spot Sacramento	200	0	0	0	0	0	0	0	0	0	0	0	0
Option Sacramento	100	0	0	0	0	0	0	0	0	0	0	0	0
Spot San Joaquin	200	0	0	0	0	0	0	0	0	0	0	0	0
Option San Joaquin	100	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Spot export area	200	0	0	0	0	0	0	0	0	0	0	0	0
Option export area	100	0	0	0	0	0	0	100	0	0	0	0	0
Purchased but undelivered													
Sacramento		*28*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*100*	*80*	*60*	*40*	*20*	*0*
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*10*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		30											
Financial Balance		*42.6*	*42.6*	*42.6*	*42.6*	*42.6*	*42.6*	*32.6*	*32.6*	*32.6*	*32.6*	*32.6*	*32.6*

GAME 1 Water Y 1994 Values in italics are calculated

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*-133*	*0*	*0*	*133*
Sacramento River Market Releases	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River Market Releases	0	0	0	0	0	60	60	0	0	0	0	0
Delta Cross Channel Closed?	y											
Bacon Island Diversions	0	0	120	0	120	0	0	0	0	0	0	0
Pumping from/to Bacon to/from CCFB	*0*	*0*	*120*	*0*	*0*	*0*	*120*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions												
Diversion to Island	0	0	0	0	120	0	0	0	0	0	0	0
Release for export	0	0	0	0	0	0	0	0	0	40	40	40
Change in CCFB/Tracy Diversions	*0*	*0*	*-340*	*113*	*60*	*0*	*-30*	*0*	*-109*	*40*	*40*	*141*
Total Change in Delta Diversions	*0*	*0*	*-220*	*113*	*300*	*0*	*-30*	*0*	*-109*	*40*	*40*	*141*
Divert for EWA from Store/buy, surplus				102	180							101
E/I relaxation				11								
Carriage Water	0	0	0	0	0	0	0	0	-24	0	0	32
Change in Delta Outflow	*0*	*0*	*220*	*-113*	*-300*	*60*	*90*	*0*	*-24*	*0*	*0*	*32*
South of Delta market "deliveries"	0	0	0	0	0	0	0	0	0	0	0	0
MWD Shift Water to/from EWA	0	0	0	0	0	0	0	0	0	0	0	0
Efficiency/ET	2	2	2	2	2	2	3	3	3	3	3	3
Change Groundwater Storage	*0*	*0*	*0*	*0*	*62*	*2*	*-10*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage	*2*	*2*	*-218*	*115*	*0*	*0*	*103*	*3*	*-106*	*3*	*3*	*104*

End of Month Values for EWA Accounts

	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		0	0	0	0	0	0	0	0	133	133	133	0
Delta Storage		0	0	0	0	120	120	0	0	0	0	0	0
SemiTropic	200	50	50	50	50	70	70	70	70	70	70	70	70
Kern	100	170	170	170	170	190	190	180	180	180	180	180	180
Gravelly Ford	100	20	20	20	20	42	44	44	44	44	44	44	44
Borrowed San Luis		101	103	-115	0	0	0	103	106	0	3	6	110
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Purchased	$/af												
Spot Sacramento	200	0	0	0	0	0	0	0	0	0	0	0	0
Option Sacramento	100	0	0	0	0	0	0	0	0	0	0	0	0
Spot San Joaquin	200	0	0	0	0	0	0	20	0	0	0	0	0
Option San Joaquin	100	0	0	0	0	0	60	40	0	0	0	0	0
Spot export area	200	0	0	0	0	0	0	0	0	0	0	0	0
Option export area	100	0	0	0	0	0	0	0	0	0	0	0	0
Purchased but undelivered													
Sacramento		*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*6*	*8*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		30											
Financial Balance		*62.6*	*62.6*	*62.6*	*62.6*	*62.6*	*56.6*	*47.6*	*47.6*	*47.6*	*47.6*	*47.6*	*47.6*

D-017093

GAME 1	Water Y 1995	Values in italics are calculated											
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*-145*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases		0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin River Market Releases		0	0	0	0	0	0	0	0	0	0	0	0
Delta Cross Channel Closed?													
Bacon Island Diversions		0	0	60	120	120	0	0	0	120	120	120	120
Pumping from/to Bacon to/from CCFB		*0*	*0*	*60*	*120*	*0*	*0*	*60*	*56*	*120*	*120*	*120*	*120*
Webb Tract Diversions													
Diversion to Island		0	0	0	120	0	0	0	0	0	0	0	0
Release for export		0	0	0	0	0	0	0	0	0	0	0	0
Change in CCFB/Tracy Diversions		*0*	*0*	*-160*	*-270*	*0*	*188*	*60*	*0*	*-440*	*0*	*0*	*0*
Total Change in Delta Diversions		*0*	*0*	*-100*	*-30*	*120*	*188*	*60*	*0*	*-320*	*120*	*120*	*120*
Divert for EWA from Store/buy, surplus							188	60			120	120	120
E/I relaxation													
Carriage Water		0	0	0	0	0	0	0	0	0	0	0	0
Change in Delta Outflow		*0*	*0*	*100*	*-115*	*-120*	*-188*	*-60*	*0*	*320*	*-120*	*-120*	*-120*
South of Delta market "deliveries"		0	0	0	0	0	0	0	0	0	0	0	0
MWD Shift Water to/from EWA		0	0	0	0	0	0	0	0	0	0	0	0
Efficiency/ET		2	2	2	2	2	2	3	3	3	3	3	3
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*60*	*60*	*56*	*-30*	*0*	*0*	*50*
Change in San Luis Storage		*2*	*2*	*-98*	*-148*	*2*	*130*	*63*	*3*	*-287*	*123*	*123*	*73*

End of Month Values for EWA Accounts

	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		0	0	0	145	145	145	145	145	145	145	145	145
Delta Storage		0	0	0	0	120	120	60	4	4	4	4	4
SemiTropic	200	70	70	70	70	70	90	110	130	120	120	120	140
Kern	100	180	180	180	180	180	200	220	240	230	230	230	250
Gravelly Ford	100	44	44	44	44	44	64	84	100	90	90	90	100
Borrowed San Luis		112	114	16	-132	-130	0	63	66	-221	-98	25	98
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Purchased	$/af												
Spot Sacramento	200	0	0	0	0	0	0	0	0	0	0	0	0
Option Sacramento	100	0	0	0	0	0	0	0	0	0	0	0	0
Spot San Joaquin	200	0	0	0	0	0	0	0	0	0	0	0	0
Option San Joaquin	100	0	0	0	0	0	0	0	0	0	0	0	0
Spot export area	200	0	0	0	0	0	0	0	0	0	0	0	0
Option export area	100	0	0	0	0	0	0	0	0	0	0	0	0
Purchased but undelivered													
Sacramento		*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*	*16*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*4*	*0*	*0*	*0*
Payments to EWA		30											
Financial Balance		*77.6*	*77.6*	*77.6*	*77.6*	*77.6*	*77.6*	*77.6*	*77.6*	*73.6*	*73.6*	*73.6*	*73.6*

Game 1: 1995

October	Historic Conditions: Outflow=4,000; exprts=5300; E/I=48; X2>81. Shasta at 1.83MAF. SL = 357TAF. DS at 88km. Pop low. Winter run 200; spring run 1500. SJ at 4500. Outflow limiting. Could relax E/I for five days, but likely controlled by water quality. Balanced conditions and little capacity to export. No Action. No fish to worry about.
November	Historic Conditions: Outflow=5900; exprts=6000; E/I=.51; X2>85. Shasta at 1.83MAF. SL = 357TAF. NO fish. Opportunities: E/I could be relaxed, but likely fighting WQ at least until it starts to rain. Balanced conditions. NO ACTION.
December	Historic Conditions: Outflow=9800; exprts=7400; E/I=.42; X2=85. Shasta at 1.83MAF. SL = 357TAF. Exports up to 13k with new capacity unless restricted. SL at 500TAF. Storing water in Shasta until flood releases in mid January. Fish: set export limits to 8,000 in last two weeks of Dec or 10,000 for month. Minimum releases for AFRP thus no basis for backing up into NOD storage. 8,000 exports for last two weeks with 2000 through Bacon. Cost of 100 TAF of SJ EWA.
January	Historic outflow: 106k; exp = 11.5; E/I = .1; X2 = 61. Low DS abundance. Moderate chinook and smelt salvage 100+/TAF. Forecast for dry conditions at beginning of month. SJ flow to 11k at end of month. Minimum releases for AFRP thus no basis for backing up into NOD storage. Fish Action: 10,000 exports for month with 2000 through Bacon.
February	Historic outflow: 85k; exp = 8.9; E/I = .11; X2 <56. After Dec 15 projects can go up to 1/3 of Vernalis flow which allows exports up to 15k.
March	Outflow-179k; exp=2800; E/I .04; X2 =53. Low salvage because of very low pumping - would be higher if pumping at high rate. Fill GW. No Action for fish.
April	Outflow=91,000; exports= Move 60 into GW and 60 into SL (from Bacon). No Action for fish.
May	Outflow = 100,000; exports 4200 (1500 VAMP; 3000 in 93); High SJ flow. No Action for fish.
June	Outflow=50,000; exp 7300; E/I .12; Could pump 13k. Restricted exports to 5,300 to protect splittail. Pump 2,000 through.
July	

	part and 1500 under VAMP in second half. Many options. Augment flows in SJ in first two weeks. $6M in April to purchase. Cut back on exports by 1000 cfs (to about 4,000 cfs) for first two weeks in April by using 20TAF from Bacon and 10 TAF from Kern. Pumping cost of $1 for ground water pumping from Kern. X2 moved down several kms.
May	Outflow=8100; exp=2100; E/I= .17; X2 =79. Full VAMP through month. 1500 export for VAMP? SL at 1.28MAF plus 100 TAF of EWA water. VAMP flows in SJ 5000 through May 15, then fall to 1500. No additional action.
June	Outflow=6200; exp=5900; E/I=.35; X2 =81. San Joaquin flow about 1200 cfs. E/I limiting. DS historic salvage was high in May. DS upstream in western Delta and lower Sac. X2 moved down approximately 7 kms by increased outflow. Splittail salvage approach 100/TAF. Smelt restrictions historically. How well this shift in X2 benefits salvage is unknown – would be able to monitor real time. Could shift SL storage to Shasta and still meet winter run temp requirements below Keswick, but would provide better temp control later in summer. Shift would affect later ability to reduce exports, but not expecting to do that for a couple months. Plus a 20 % credit. (will be paid back later when this EWA water is released). Cuts exports 130 TAF by backing up into Shasta. Reduce exports 1300 cfs by backing up. E/I also improves; X2 slightly impacted up to 80 km still, but exports are so low that smelt should be OK. MAY CAUSE AN ACCOUNTING PROBLEM RELATIVE TO E/I RATIO. Clorides reduce form 100+ to below 50.
July	Outflow=4000; exp=5900; E/I=.40; X2 =85. Dsmelt are downstream. No ability to pull more water with outflow at 4,000. No action. Start moving project island water.
August	No changes. No Action. Move more project island water.
September	Concern about low Keswick releases. Move remainder of project island water. Releases of 2000 more out of Keswick. Move all of EWA Shasta water to SL with 20% carriage penalty.

August	
September	

D-017097

Game 1: 1991

October	
November	
December	Outflow is reduced, likely increase in salinity in the S. Delta. Increase probably over stated in G-model due to first storm-of-year runoff.
January	Previous fall smelt index was 364 centered in lower Sac. Low snow forecast. Likely space in SanLuis. NO DESIRE to move water from Shasta or reduce exports.
February	E/I controlling early and outflow later. Capture 50TAF of small early storm. TOC's are higher, concern about taking this water, but divert all we want toconnected island. Didn't fill island because of concern for BO for DW and X2 requirements.
March	Miracle March!! Turn on large Banks. No smelt but some salmon showing. Rare and larger types of salmon young in salvage in early March, thus take steps to reduce pumping. Would not relax E/I, despite being able to pick up 20TAF a day for EWA. Divert 2,000 cfs water for exports through Bacon forebay because it has better screens. Reduce exports from 10,000 allowed under baseline to 5,000 in second half of March to protect salmon. Keep 2,000 cfs on Bacon. HOR adjustments are made as yet. Effective decrease of 3,000 cfs for 2 weeks (90TAF). Benefit salmon more than smelt. Can't back upstream because of minimum releases. So X2 and outflow would benefit from the 3,000 less export.
April	Outflow and E/I are bringing down exports. VAMP took over on 15th. X2 slowly approaches Collinsville. 100-1000 smolts per TAF. Vernalis flows up. Purchase water taken up by VAMP purchases. Cost would be 200/AF for any purchases NOD supplies. Double flows from SJ for first two weeks - 10TAF ($2million). Reduce salmon densities or moves them faster, thus reduces entrainment losses. Held export in first two weeks to 7000. Maybe 60TAF of cost for reducing first half entrainment/exports. Additional indirect benefits. Concern about SL low storage. Did not get HOR benefit in first two weeks for salmon, but benefit helps delta smelt and other fishes. Take 10TAF each from Gravelly and Semitropic to improve SL storage, can't use Kern because of low priority.
May	Keswick releases are higher than minimums; can reduce by 3,000 cfs. Oroville and Folsom don't have extra. VAMP protects in early May. Reduced pumping through May. Historic pumping reduced from 2500 to 1500 cfs. No extra protection needed. Take 10TAF each from Gravelly

	and Semitropic to improve SL.
June	DCC open again. Exports at minimum already. June ds dist high in western Delta. But May extra flow may have pushed them further downstream as much as 10km. Don't do anything. No fish triggers for ds.
July	Only ground water pumping.
August	Only ground water pumping.
September	Only ground water pumping.
Yearly totals	Total exports about 2.8MAF from Russ's model is similar to DWRSIM. Accord gave most benefits for fish reduction. Started with EWA half full, not likely to have been there.Projects would have gained from EWA actions and new facilities. Positive benefits especially on SanJoaquin salmon. Project DW did its thing independent from the EWA process.

D-017099

Game 1: 1992

October	E/I not controlling. Outflow limits controlling. No excess outflow. Delta water quality may be demanding 1000+ cfs extra. Outflow requirement is uncertain - 3700 to 5,000. Pumping 10 TAF. Poor salmon adult returns. High smelt index (600+). Kern not available, but pump from there if we can.
November	Minimum conditions. Outflow controlling. Some high salmon salvage days. Not much can be done. Shasta only 600TAF of storage. Minimum flow and temperature releases, not export. Exporting what they could of those flows. Lost temp control from low storage level, but not a temp problem. Yuba water available, if Wilkins SI criteria relaxed because nobody is pumping. Temp control device alters this somewhat.
December	No change, except Christmas storm. No action.
January	Balanced conditions. Can't back up water. No action.
February	Valentine's storm. Fill islands and use big pumps. Winter run entering Delta and showing at pumps. Buy SJ water? Joint point reverse using fed pumps picks up capacity to fill state SL. Could relax E/I and export 1,000 cfs early in month. Move water onto islands later in month to split (60TAF on each). 60TAF more in state SL than model shows; EWA in SL is now at risk. Smelt and salmon triggered later in month. Pump more into SL early (60TAF) and back off later as fish show up at pumps (140TAF).
March	Two storm peaks. Chinook, splittail, and steelhead salvage declining. DCC closure would provide some basic protection for Sac salmon and steelhead. E/I limiting as inflow falls during month. Pumping rate from DWRSIM for month was 8230 cfs. Salvage relatively high for salmon and steelhead. 362 ds index from previous fall. SJ escapement was very low. We chose option of cutting exports by 3,000; later we could try increasing SJ flows.
April	VAMP in late April. Exports at 2890. Historic salvage was high for chinook, but substantial benefit from VAMP and closure of HOR. Left with early month salvage limited by outflow requirements. Might trigger VAMP differently from April 15. Or purchase water to do same, by augmenting SJ flow and pump water through screened Bacon. 1500 cfs of extra outflow with intake through Bacon screens to CCF.

May	Exports and outfall are low; full VAMP applied with addition of in-Delta AFRP. Ramp can apply to exports or SJ inflows. Nothing to do in May.
June	In balance conditions. Low exports and inflows. No actions. Project problem of meeting X2; will have to release upstream water.
July	No salvage in July. Some EWA water could be released into upper Sac and moved to San Luis into EWA. Carriage water cost? 20% loss to carriage water. 20 TAF released and 16 picked up. Projects emptied Webb and delivered 120 TAF so no impact on San Luis. Plus 30 TAF purchased from Yuba with 20% carriage penalty. Benefit to water quality from VAMP and X2.
August	Same as July. But shift to later in summer.
September	Outflow limiting, in balance. Moving water. Consumptive use in Delta going down. Exports up to 3600 cfs. No action, except moving

D-017101

Game 1: 1993

October	In balance. Nothing going on. BOR releases for fish. Keswick 3540; Tracy 1258. Allowable export of 3220 cfs. Meeting Shasta temp req. Outflow 5471. Salinity outflow controlling. X2 90 km. Salmon escapement very low. 200 cfs out of Yuba, 80% picked up in San Luis.
November	Exports at 4139, outflow of 3500; balanced conditions. 200 cfs out of Yuba, 80% picked up in San Luis. San Luis storage only about 120 TAF.
December	Exports 6064. E/I is .65 controlling early but outflow later. Relax E/I but chlorides may be something to consider. Five days of filling Delta Wetlands islands. Fish monitoring would be watched closely as we did this. 90 TAF added to our San Luis EWA account during the first 10 days of month. Low density but high rate of pumping may add up the fish. Outflow controlling in latter half of month. Then cut back 40TAF at end of month.
January	Get fish and water. Outflow aver 56,525. Pumped 12,700. X2 ave at 65.9 km. Ds index is 157. DW can be used if available. Pump to both islands early in month. Adult splittail are running and salvage is high. Low densities of rare salmon (poor last fall escapement). Shasta is 2m+. SJ rose up to 10kcfs. Use island diversions as much as possible (2000cfs connector to CCF). E/I at 20%. Use a fish trigger - 30 per TAF. Delta smelt at 10 and chinook at 5. Cut back on trigger by 50% for about ½ month, not including 2,000 extra through Bacon intakes. Webb would pump 2000 all month, unless EWA paid for forgone pumping. Bacon would only be pass throughing in latter half of month, thus minimizing cost.
February	Outlfow 49k, pumping 12,500, E/I 22%; X261. Triggering Roe Island requirement, but no trouble meeting it. Pumping capacity limiting. Fish densities declining from January except for steelhead. 2000 cfs through EWA island. Entrainment in base case is higher because we pump more with expanded Banks. Refilling Webb provide a credit of 30 TAF to EWA from projects. Total hit of 120 TAF to EWA San Luis account.
March	Outflow 29k, export 12.7k, E/I 31%, X2 64. Historical had Shasta flood releases, but DWRSIM is not flood releasing because Shasta was lower. Got EWA for Shasta when it filled. March salvage densities declined. Outflow limiting early in month and E?I later in month. Empty Delta EWA storage early in month, and then

	refill. The relax E/I later in month. Picked up 90 from relaxing E/I then put 20 each into ground and rest into San Luis with the Bacon EWA water.
April	Outflow 39k, export 7300, E/I .15 , X2 km62, SL at 1.8-2. Maf. Salmon salvage picking up. Close HOR barrier and start VAMP. SJ flows 4-8k. VAMP would max at 7000 not 8500. Low densities through middle of month. Export limit of 5,000 for second week in April with 2000 of that comes through Bacon. Hit of 84TAF.
May	Outflow 30k, export 5,000, E/I= .14, X2 = 63.5. Surplus outflow of 10k. pumping only 1500 under VAMP. Historic salvage high for most, but would have been reduced by Vamp. NO ACTION, except cutting 170 TAF to keep exports at 3000 ave for month, make up with 20 TAF from SOD deliveries.
June	Outflow 19k, export 12k, E/I .35 , X2 67.4. Would pump at capacity until the end of month when E/I takes over. DS population is large, benefit from past two months of good conditions. Stay with model in first two weeks, then make some up with 40k into Delta Bacon. CCWD water quality problem was considered minor.
July	In balance. Outflow controlling . Projects want to move water. EWA could move 145 from Shasta. Left water in Shasta and moved Bacon water. No action in August for fish.
August	Outflow 4000, exports 13,000, E/I =
September	13,000, 10,000 moved Shasta water , kept delivering SOD water,

D-017103

Game 1: 1994

Thoughts to date: Game is not yet a reality. Consider alternative process modes (e.g. switch roles); after Thursday(?). Consider leaving E/I out of the base. Biological post processing (scorecards) on Thursday(?). Thursday need to address how we bring this to Q/S group. Do the same for WQ on Thursday. Need to get a variety of wet years. Proceed with 94-96. Add a year that is unknown. Continue on Tuesdays and Thursdays.

October	Outflow=5571; exports=13k; E/I =.65; X2=85. A project limit. No action. DS index >1000.
November	O=4500; export 10k; E/I=.65; X2 =85. Outflow and project limits. No Action. Closed DCC for month. WQ problem if we close for whole month.
December	O = 5847; exp= 12,617; E/I=.65; X2=84. SL is near full. Shasta is near full. Exports at project limit, except for beginning and end of month when outflow limits. Hold exports at 8,000 cfs. Also take 2,000 of 8,000 through Bacon intakes.
January	Out=10k; exp=9300 ; E/I=.49 ; X2=77. Because cut back in Dec, need to export more to fill SL. Exports would have increased to 11k to fill SL. Limiting by outflow and E/I limits. E/I raised up to .65. Debt is gone. Fish abundance is low. DCC closed. X2 moving upstream could affect delta smelt distribution and may be a concern. No Action for now. Tracy salvage rate is higher for chinook- SJ fish? - hatchery fish? - HOR? Use JPOD and take water from CCF? Room to pump water into SOD GW. Should have taken on some debt to fill GW. Or put on Bacon because we will have to release it soon anyway. Relax E/I to allow exports to go to project limits. Some outflow limits. No action for fish.
February	Outflow=25700; exports 6400; E/I =.2; X2 =70. Low salvage continues under historical conditions. San Luis limiting. Merced and Coleman hatchery fish predominate. Good to have more SJ flow. Vernalis was only 2000cfs. Options put water on Bacon (2000cfs) and in SOD GW (1000 cfs). Fill project water on Webb (2000 cfs). Tracy higher salvage densities, but JPOD would take care of this. No Action for fish.
March	Outflow=10,850; exprts=5400; E/I=.31; X2=74. San Luis is filled. San Luis controlling and outflow later in month. X2 limiting; in balanced conditions. No ds issues. Small SJ salmon and some winter run indicates a decrease in exports and higher SJ flow may be worthwhile. SJ flows at 1500 cfs. Action: bump up SJ flows from March 15 to April 15 by 2000 cfs. $6M in March.
April	Outflow=8600; exp=2900; E/I= .22; X2 =77. Densities increasing. San Luis starts full, then starts to decline. Pumped 5000 in first

D-017104

GAME 1 - BIOLOGICAL

Observations begin in June 92 of the Game (Day two).

6-92:

- No issues.

7-92:

- Flow in upper Sac for temperature control probably OK. Worst winter-run escapement ever. Now is the time to get the Shasta water down to San Luis storage.
- First major fork in the road: use for steelhead in the summer or for attraction flows in the Fall?
- Decision: Move water from the Yuba under steelhead summer temperature rationale.

8-92:

- Too early for attraction flows.

9-92:

- No fish issues.

NEW WATER YEAR (1993)

10-92:

- Escapements low. Salmon are in rivers already. Meter north of Delta stored water out slowly over a couple months. Don't want to have it disappear during the salmon incubation period. Augment Yuba by 200 cfs to move it south.

11-92:

- No issues. Salvage negligible.

12-92:

- Very low on fish. Every salmon able to swim has begun to move to the Delta with the December storm. No salmon early in the month. Therefore, biologists support decision to pump until the fish arrive. Pump a little of the storm.
- Real time fish monitoring could have either supported the decision to pump, or indicated that pumping should not go forward because fish were imminent.
- Lots of spring, winter and late fall in salvage in last 2 weeks of Dec. Low density at high pumping rates. Hard to reconcile all of data for this period.
- Decision: Cut exports from about 8500 cfs to 3000. First storm freshet and we've already chopped it! Give back the amount captured in the early ½ of the month. Cut exports back to protect salmon.

1-93

- Lots of fish. FMWT =157; quite low. 94 was lowest (101?). Coming out of dry year.
- Start taking adult DS in second week. ST finally get good conditions. Highest ST salvage at CVP on record; second highest at SWP. Likely FWS concern for ST. DS, ST, CS together justify action. Low densities of SR, WR, etc.

- Use island diversions (better screens) and reduce exports to about half (7,000) to protect assemblage of fish. Control exports on Mesick ration to SJR? Adult DS and adult ST, out-migrating SJR CS. Low densities of CS, but there are not many CS this year; this is as high a density as we will see this year.
- Fish triggers don't trigger much in the first two weeks. In the latter half of the month, use 2000 cfs passed through Delta islands to reduce the cost of reducing exports by half when they do trigger.

2-93:

- There were some winter run; some fry; some ST; lot of steelhead; densities declining from Jan, except steelhead. Could be a critical short-term steelhead event. Set trigger to 10 steelhead per TAF to protect.
- Special note: Juvenile WR will also benefit from whatever is done here.
- Reduce exports by half during triggered steelhead days.

3-93

- CS density is real low; fish look good in March; good time to relax standards and build up water in storage.
- This month is in between the adult DS and the juvenile abundance peaks.

4-93

- Lots of CS smolt size on the rise a week before VAMP.
- Limit exports to protect these SJR smolts and some SR YOY during the second week of April, before VAMP begins.

5-93

- Last half of May has lots of fish historically. Therefore, keep exports down to about 3,000 during the last 2 weeks, aftre VAMP is complete, for CS, DS, ST.

6-93

- DS unique situation; good outflow and X2 - population is west of confluence; still lots of salvage. Have had a dramatically shift from historical. Hard to justify based on DS distribution.
- CS problem in first two weeks; don't go into water recovery mode until mid-June. Stay with the reduced export modeled operations for first two weeks;
- Note SB salvage was very high, but this was not a factor in operations decisions.

7-93, 8-93, 9-93

- No fish issues.
- SPECIAL NOTE: In another iteration, hold flows in Shasta for later temperature benefits, rather than moving south to pay off south of Delta debts.
- Note: Be careful about flow fluctuations in the upper river during this period as EWA water is moved down.

3-30-99 EWA GAMING

Notes begin with Day Three of the game (October 1993):

October 1993

Background: CS-FR escapement: healthy 103,000; SJR =starting to rebuild; 2300 adults, 900 jacks; WR still depressed; 1993 WR escapement 300;

No substantial fish protection issues evident for this month

November 1993

Noticable numbers of larger juvenile salmon are being salvaged.

Note: Closed DCC at beginning of the month based on fish monitoring.

December 1993

DS over 1,000 in FMWT; @ 79.3; no DS concerns this month.

Large juveniles continue to be salvaged.

FORK: Should we use some of EWA assets to reduce exports? We let the large juveniles just go in November; need to give them some protection this month. 5000 cfs reduction for 10 days uses all EWA water in SL.

DECISION: Hold exports at 8,000 for the entire month to protect large CS juveniles and take 2000 cfs through Delta island (Bacon) screens. Cost for 25 days about 200 TAF.

January 1994

DS are farther downstream @ 75 km. Low DS salvage. If we moved X2 about 3 km, what would be the potential impact on DS? We may have changed conditions by moving X2 upstream with the 20% increase in exports. Take no action this month for DS.

DCC closed, but would not have been closed historically. Need to adjust thinking about salvaged

OK on CS this month. In November, Merced hatchery released 150-200 mm size fish; still seeing some in export salvage and they will probably be around for a while. Accounts for some of the differences we are seeing. Vernalis flows about 1700 cfs, so probably not moving SJR fry into Delta.

No fish actions this month.

February 1994

DS @ 80 km; monthly DS salvage = 174 adults; X2 @71 km. FMWT = 1000. Should not use assets at this time; will probably need later.

Historical DCC closed.

Most of CS in the Delta are Merced yearlings, plus some Coleman hatchery LFR are beginning to appear. Vernalis Q=2000. Monitoring data would be better than we currently have with a marking program.

Fork: Need more flow in SJR to help SJR salmon?

Decision: Don't buy flow on SJR. No fish actions this month.

March 1994

DS 78.8; salvage = 169 adults (mainly at end of month); X2 =74.4

CS: small unmarked (probably SJR) fish are showing up and some WR are showing up.

FORK: Add flows for SJR CS and/or curtail pumping for WR?

Monthly Vernalis 2200 cfs.

DECISION: Augment 2000 cfs beginning in mid-March through mid April. Amounts to 120 TAF, $12 million. 60 TAF/ month and $6 million/month. Exports already low; no need to further restrict.

April 1994

DS @ 98.2; salvage =948; X2=77.5; trigger expected later in month.

Note: Need to reconcile that DS numbers do not reflect the VAMP.

Vernalis flow was increased last month and first two weeks of April.

Fork: Decrease exports in first two weeks of April for salmon?

Decision: Cut exports by 30 TAF for SJR salmon. Cut by 1000 cfs for the first two weeks of April.

May 1994

Tough issues: How much will the VAMP have changed entrainment values for DS, CS and ST? Has the past months X2 change downstream helped reduce DS entrainment? How much?

There was historically a huge spike in DS. Actions on X2 and export changes may well have reduced this spike.

Fork: What else is there to do? Spot purchase on the San Joaquin?

Decision: No purchase; flows pretty high (5000-6000)

Note: This April -May SJR peak matches pattern of history.

June 1994

DS mean 93 km early June; later shifts down stream.

Same tough issues as last month regarding VAMP and X2 need resolution.

Historically had DS restrictions.

DS population can be expected to move downstream sometime in coming months.

No CS issues.

Have increasing ST (SJR) densities.

Improved X2 by 7 km; outflow is 2000 cfs better; SJR = 1525 cfs

Fork: WR and Keswick releases . Keep it for later temperature purposes?

Decision: 11,000 cfs @ Keswick is enough for temperature control; 13,000 not needed. Therefore, back 130 TAF into Shasta from SL. Brings Shasta up above 1.9 pool with potential temperature benefits?

Export reduction by 1700 helps ST.

Note: Confusion about details. Revisit. Reduction in pumping for free?

July 1994

DS are out of the woods; have moved downstream.

No ST issues.

SB salvage increased 3-fold from 150,000 to about 435,000.

August/September 1994

No fish issues.

NEW WATER YEAR

Note: Dealing with history, not model outputs

October 1994

DS: Lowest FMWT; around 88 km

Chinook salmon escapement = WR: couple hundred; SR: 1600; SJR: 4500.

November 1994

No fish present in Delta.

December 1994

Big salmon month; about same numbers in both facilities.

Previous FMWT=124 very bad.

Fork: Reduce exports to increase survival of salmon?

Decision: Reduce exports to 8,000 from 12,000 for the second two weeks. 2000 through the Delta wetlands screens.

Fork: Buy SJR flow? (SJR= 1300 cfs)

Decision: No acquisition.

January 1995

DS: Triggered by model, but needed action is not clear. Density <10/TAF.

Fork: Big SJR pulse in salvage. Lot of fish have moved into the Delta. Can make the case that lots are surviving well in Delta and the entrainment loss may not be significant; as in dry period. On the other hand, we reduced exports in Dec to protect a similar CS distribution. Conservative approach would be to reduce exports in the second half of the month and help Delta smelt too.

Decision: Start export reduction at 10,000 (11,500 cfs) with 2000 through Bacon and stay with for the month.

February 1995

No DS problems.

Salmon fry and steelhead present in salvage.

Take no action for fish.

March and April 1995

No fish issues.

No actions.

May 1995

VAMP holds exports low.

High CS and record high ST

No fish actions

June 1995

Fork: Reduce exports from 7,300 historical (would go to 13,000) to 6500 cfs to protect ST?

Decision: Salvage of splittail was reduced by half (to 800,000), but was considered to still be too high.

Fork: 5,000 cfs exports; with 2,000 thru Bacon to reduce salvage of ST to 400,000.

REVIST THIS ISSUE ON THURSDAY

Game 2

D-017111

Game 2 - End Stage 1

Basic Description: Game 2 represents conditions that would be in place toward the end of Stage 1. JPOD, Delta island storage, groundwater banks would be available. 21,000 cfs export capacity including 6000 to islands

Beginning Assets:

- $30 million annual fund for spot market water purchases.
  - NOD (200 TAF)
  - SOD (200 TAF)
  - Export (200 TAF)
- Ground Water Banks
  - Semitropic (200 TAF of storage space available with 20 TAF/mo in and 10 TAF/mo out limits)
  - Kern (100 TAF of storage space available with 20 TAF/mo in and 10 TAF/mo out limits)
  - Gravelly Ford (100 TAF of storage space available with 20 TAF/mo in and 10 TAF/mo out limits)
- Expanded Shasta (50 TAF per year if reservoir fills)
- Debt carrying ability in project reservoirs (primarily San Luis and Shasta)
- Delta Islands evapotranspiration savings to EWA (15 for projects; 45 TAF/year for EWA)
- Delta Island storage connected to CCF (200 TAF, 60 TAF in or out per month limitation)
- $ 3 million for WQ purchases.

Asset Generating Capability:

- Relaxation of Export/Inflow standards
- Export water to San Luis or groundwater banks when projects were not at capacity.

Baseline Conditions: Accord + AFRP, JPOD

- 1995 demand level
- 10,300 cfs expanded capacity for Banks pumping plant
- Delta island storage, Banks, and Tracy intakes are all screened.
- 120 TAF of Delta storage for projects (60 TAF in/out limit per month)

Actions Taken:

- Relaxed E/I standard in dry and wet years to export water into EWA account in San Luis reservoir and groundwater banks.
- Limited project exports in winter and spring to reduce fish being drawn to pumping plants.
- Pumped water to Delta Island storage for EWA (Bacon complex, but did borrow Webb storage at times) and projects (Webb).
- Pumped water to EWA accounts in San Luis and groundwater Banks when excess capacity allowed.
- Purchased export area water to pay back EWA debt in San Luis.
- Backed up water into Shasta EWA account when possible coincident with export reductions.
- Purchased water from Sacramento and San Joaquin for release to rivers and Delta, and payment of debt in San Luis.

Water Operations Summary: Gaming Exercise
April 19, 1999 Draft GAME 2.

Scenario: April			Target Year: End of Stage 1
Possible Water Supply Measures	Details	EWA/ Users Division	How to Model How to Game
South Delta Program - 10.3 kcfs	10.3 kcfs	Users below E/I EWA above E/I	Model in baseline. EWA may use in game when available or above E/I.
JPOD. No individual State/ Federal sublimits	No state or federal sublimits apply	Projects below E/I. EWA above E/I	Model in baseline.
Allow E/I variances			EWA may allow pumping above E/I for credit..
Allow in-Delta AFRP varieances			EWA may allow pumping above AFRP in-Delta for credit..
Kern Water Bank	300 kaf storage. 20 kaf/ month in. 20 kaf /month out.	200 kaf Projects 100 kaf EWA	Model Project storage in model using full in/out capacity. EWA storage by hand. For game, EWA assured of 10 kaf/month in/out, but may use full capacity when unused by Projects. (A slight inconsistency. Check during game). Capacity is high priority -- no preemption by Kern.
Semitropic high priority storage	200 kaf storage 20 kaf/ month in. 10 kaf/ month out.	EWA	Operate by hand in game.
Gravelly Ford Groundwater	300 kaf storage. 20 kaf/ month in. 20 kaf /month out.	200 kaf Projects 100 kaf EWA	Operate Project share in model. Operate EWA share by hand. For game, EWA assured of 10 kaf/month in/out, but may use full capacity when unused by Projects. (A slight inconsistency. Check during game).
Shasta Dam Expansion	50 kaf storage	Projects	Operate in model
Webb Tract	120 kaf. 2 kcfs in/out	Projects	Operate by hand under Delta Wetlands rules.
Bacon, Woodward, Victoria	200 kaf. 4 kcfs in from Delta. 2 kcfs 2-way connector with Clifton Court	EWA	Operate by hand. Can divert water using Project rights up to total south Delta pumping of 15 kcfs, or by diverting water when Delta out-of-balance, even if total diversions rises above 15 kcfs. EWA may grant variences to Delta Wetlands rules.

Possible Water Supply Measures	Details	EWA/ Users Division	How to Model How to Game
ET reductions on Delta storage islands	60 kaf/year average	Project 15 kaf/yr EWA 45 kaf/yr	Operate by hand in game.
SOD water purchase options	No limit, but see price schedule	EWA	Operate by hand in game
NOD water purchase options	No limit, but see price schedule.	EWA	Operate by hand in game
Spot Purchases	No limit, but see price schedule	EWA	Operate by hand in game
Demand shifting	100 kaf. Short term storage lease in San Luis.	EWA	Operate by hand in game
Screens at south Delta export intakes			Assumed in place for game.
Access Surplus Capacity		EWA	Operate by hand in game

D-017114

Notes

1. Remaining issues, notes:

- o Groundwater input/output capacities
- o New cost schedules (below) for purchases, pumping, etc.
- o CALFED plans to fund on the order of 150 kaf/yr of efficiency improvements. Can those be credited to project yield?
- o Giving 10.3 kcfs to Projects with no new controls is risky for EWA -- could greatly increase cost of export reductions. Need to watch this during game.

Initial Conditions

Assume that:

- o All EWA storage is 50% full at the beginning of the game.
- o EWA starts w/ $30 million.

EWA Budget

$30 million/year, paid on October 1 of each year. Funds may accrue. The EWA may borrow up to $30 million of future income. EWA funds accrue interest at 5% per year. Borrowing costs 5% per year. Capital costs for assumed facilities are outside the game. EWA may build up its fiscal reserves by selling or leasing its rights to water or facilities.

Price Schedules

Discretionary and operating costs must be paid for using the EWA budget. These costs include:

- o Cost of options
- o Cost of purchases
- o Cost of groundwater pumping
- o Cost of Project transportation (but with credits for avoided costs from the Projects)

Assumed prices:

1. Options

   $10/af for water to be delivered next year. Options must be purchased before October 1.
   $60/af to call options upstream of the Delta.
   $100/af to call options in export areas
   All options must be called before April 1 or the water reverts to the seller.

   The price of options is doubled during dry and critical years. The price of calling options rises by 50% during dry and critical years (when projections are greater than 50% for dry or critical

2. Spot purchases

   $200/af for the first 200 kaf/yr
   $300/af for the next 200 kaf/yr
   etc.

   Add $100/af during years projected to be dry and critical with > 50% probability.

3. Water sales by EWA

   Price to be negotiated during game.

4. Groundwater pumping costs

   Kern/ Gravelly Ford at $100/af
   Semitropic at $200/af

5. Demand Shifting

   $100/af to rent up to $100 kaf of storage in San Luis from MWD

Intention to shift storage must be declared by June 1
Water must be paid back by January 1 of next year or $1000/af payment

6. Project Transportation Costs

Still needs work. Should vary by time of year and by the total amount of export pumping. As pumping increases, the marginal cost of electricity will increase. EWA should pay for extra transporation cost, and get credits for reduced transportation costs.

Water Quality Account

50 kaf of high priority storage in Shasta, operated by hand. Fills when Shasta spills.

Up to $3 million/yr. Account does not accrue

Modeling Basis

Based upon the matrix above, the modeling upon which the game would be founded would be run with the following assumptions:

- 1995 Level of Development?
- Accord + VAMP
- All AFRP
- Trinity
- South Delta Improvements (10.3 kcfs)
- Unlimited JPOD
- Gravelly Ford storage (200 kaf)
- Kern Water Bank Storage (200 kaf)
- Shasta storage (50 kaf)

Water Supply Evaluation

The results from the modeling basis plus water developed at Webb Tract, plus ET gains, plus any efficiency water allocated to the Projects, will roughly represent estimated Project deliveries.

D-017117

Game Rules

- EWA has the right to carry debt and to use Project facilities, provided it can assure no harm, unless arrangements for compensation are agreed to in advance. Thus, the EWA may borrow against future water supplies, may shift Project storage from upstream storage to downstream storage, etc., provided that it can make the Project's whole before the water is needed.
- Unless otherwise specified, EWA has low priority access to Project facilities.
- Movement of water through the Delta when outflow is controlling has a carriage water cost of 20%. Backing water upstream via export reductions when outflow is controlling reduces carriage water by 20%.

GAME 2 **Water Year** **1991** Values in italics are calculated

		IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases			0											
San Joaquin River Market Releases			0						30					
Delta Cross Channel Closed?														
Bacon Island Diversions														
Pumping from/to Bacon to/from CCFB			*0*	*60*	*40*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions														
Diversion to Island						60								
Release for export														
Change in CCFB/Tracy Diversions			*0*	*0*	*0*	*0*	*0*	*-42*	*0*	*0*	*0*	*0*	*0*	*0*
Total Change in Delta Diversions			*0*	*0*	*0*	*60*	*0*	*-42*	*0*	*0*	*0*	*0*	*0*	*0*
Water Generated by E/I Relaxations			0	0	0	0	0	170	0	0	0	0	0	0
Carriage Water														
Change in Delta Outflow			*0*	*0*	*0*	*0*	*0*	*42*	*30*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"			0											
MWD Shift Water to/from EWA														
Efficiency/ET			3	3	3	4	4	4	4	4	4	4	4	4
Change Groundwater Storage			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage			*3*	*63*	*43*	*4*	*4*	*-38*	*4*	*4*	*4*	*4*	*4*	*4*
End of Month Values for EWA Accounts			0											
	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Increased deliveries									0	0	60	20	0	0
Upstream Surplus Capture			0	0	0	0	0	0	0	0	0	0	0	0
Delta Surplus Capture			0	0	0	0	0	0	0	0	0	0	0	0
EWA Shasta		25	25	25	25	25	25	25	25	25	25	25	25	25
Bacon Storage		100	100	40	0	0	0	0	0	0	0	0	0	0
SemiTropic	200	100	100	100	100	100	100	100	100	100	100	100	100	100
Kern	100	50	50	50	50	50	50	50	50	50	50	50	50	50
Gravelly Ford	100	50	50	50	50	50	50	50	50	50	50	50	50	50
EWA San Luis		0	3	66	109	113	117	79	83	87	91	95	99	103
Borrowed MWD		0												
Year Type: 1 for dry/critical. 0 otherwise			*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10	10	100											
Option San Joaquin	10	10	100											
Option Export	10	10												
Spot Sacramento	200	100												
Call Sacramento	60	30							100					
Spot San Joaquin	200	100												
Call San Joaquin	60	30							100					
Spot export area	200	100												
Call export area	100	50												
Sacramento		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*100*	*100*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*70*	*70*	*70*	*70*	*70*	*70*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Purchases			*2*	*0*	*0*	*0*	*0*	*0*	*18*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA			*30*											
Interest														
Financial Balance		*0*	*28*	*28*	*28*	*28*	*28*	*28*	*10*	*10*	*10*	*10*	*10*	*10*
Approximate Water Buying Power		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*170*	*170*	*170*	*170*	*170*	*170*

Summary

1991	1992	1993	1994	1995	
200	200	300	200	0	Purchases
170	160	241	45	102	Relaxed Stds
45	45	45	45	45	Efficiency
0	0	25	0	50	Upstream Surplus Capture
0	0	0	230	584	Delta Surplus Capture

Water Quality purchases														
amount	cfs			500										
amount	TAF			32										
Water Quality Optior	TAF				90									
	cost $m				1.8									
water quality call on options	TAF								90					
	cost $m								1.8					
Releases for water quality													30	30
Balance													60	30

GAME 2 Water 1992 Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases		50	50										33.333
San Joaquin River Market Releases		35	35				60	40					
Delta Cross Channel Closed?													
Bacon Island Diversions								60					
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*-133*	*133*	*60*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island						0	120						
Release for export												120	
Change in CCFB/Tracy Diversions		*71.5*	*71.5*	*0*	*0*	*-90*	*-180*	*-20*	*0*	*0*	*0*	*210*	*26.63*
Total Change in Delta Diversions		*71.5*	*71.5*	*0*	*0*	*-90*	*-60*	*40*	*0*	*0*	*0*	*210*	*26.63*
Water Generated by E/I Relaxations		0	0	0	0	40	120	0	0	0	0	0	0
Carriage Water		13.5	13.5										6.67
Change in Delta Outflow		*13.5*	*13.5*	*0*	*0*	*90*	*120*	*0*	*0*	*0*	*0*	*-210*	*6.703*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Efficiency/ET		3	3	3	4	4	4	4	4	4	4	4	4
Change Groundwater Storage		*0*	*0*	*0*	*0*	*40*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*74.5*	*74.5*	*3*	*4*	*-259*	*-43*	*44*	*4*	*4*	*4*	*94*	*30.63*
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Increased deliveries													
Upstream Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
EWA Shasta		25	25	25	25	25	25	25	25	25	25	25	25
Bacon Storage		0	0	0	0	133	0	0	0	0	0	0	0
SemiTropic	200	100	100	100	100	100	100	100	100	100	100	100	100
Kern	100	50	50	50	50	70	70	70	70	70	70	70	70
Gravelly Ford	100	50	50	50	50	70	70	70	70	70	70	70	70
EWA San Luis		177.5	252	255	259	0	-43	1	5	9	13	107	137.63
Borrowed MWD													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10	100											
Option San Joaquin	10	100											
Option Export	10												
Spot Sacramento	200												
Call Sacramento	60							100					
Spot San Joaquin	200							0					
Call San Joaquin	60						60	40					
Spot export area	200												
Call export area	100												
Sacramento		*50*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*100*	*66.667*
San Joaquin		*35*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Purchases		*2*	*0*	*0*	*0*	*0*	*5.4*	*12.6*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*1.0*											
Financial Balance		*39.0*	*38.95*	*38.95*	*38.95*	*38.95*	*33.55*	*20.95*	*20.95*	*20.95*	*20.95*	*20.95*	*20.95*
Approximate Water Buying Power		*53.7*	*53.7*	*53.7*	*53.7*	*29.7*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*85*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*100*	*66.667*

Summary

1991	1992	1993
200	200	300
170	160	241
45	45	45
0	0	25
0	0	0

			3										
Water Quality purchases													
amount	*cfs*		*500*										
amount	TAF		32										
Water Quality Optior TAF							90TAF						
cost $m							8.1m						
water quality call on options	TAF			90								30	30
	cost $m			1.8									
Releases for water quality			30										
Balance			0										

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GAME 2 **Water 1993** Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*-25*	*0*	*0*	*0*	*50*	*0*	*0*
Sacramento River Market Releases		33.333	33.333								100		
San Joaquin River Market Releases											100		
Delta Cross Channel Closed?													
Bacon Island Diversions													
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island					90	0							
Release for export										90			
Change in CCFB/Tracy Diversions		*27.63*	*27.63*	*90*	*-450*	*-258*	*111*	*-70*	*0*	*130*	*235*	*0*	*0*
Total Change in Delta Diversions		*27.63*	*27.63*	*90*	*-360*	*-258*	*111*	*-70*	*0*	*130*	*235*	*0*	*0*
Water Generated by E/I Relaxations		0	0	90	0	0	111	0	0	40	0	0	0
Carriage Water		6.67	6.67								15		
Change in Delta Outflow		*5.703*	*5.703*	*-90*	*360*	*258*	*-136*	*70*	*0*	*-130*	*15*	*0*	*0*
South of Delta market "deliveries"									25	25	25	25	
MWD Shift Water to/from EWA													
Efficiency/ET		3	3	3	4	4	4	4	4	4	4	4	4
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*-60*	*-60*	*0*	*0*	*0*
Change in San Luis Storage		*30.63*	*30.63*	*93*	*-446*	*-254*	*115*	*-66*	*89*	*129*	*264*	*28*	*4*
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Increased deliveries								20	120	0	160	0	0
Upstream Surplus Capture		0	0	0	0	0	25	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
EWA Shasta		25	25	25	25	25	50	50	50	50	0	0	0
Bacon Storage		0	0	0	0	0	0	0	0	0	0	0	0
SemiTropic	200	100	100	100	100	100	100	100	80	60	60	60	60
Kern	100	70	70	70	70	70	70	70	50	30	30	30	30
Gravelly Ford	100	70	70	70	70	70	70	70	50	30	30	30	30
EWA San Luis		168.26	198.89	291.89	-154.11	-408.11	-293.11	-359.11	-270.11	-141.11	122.89	151.89	155.89
Borrowed MWD													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Option Sacramento	10	100											
Option San Joaquin	10	100											
Option Export	10												
Spot Sacramento	200												
Call Sacramento	60										100		
Spot San Joaquin	200												
Call San Joaquin	60										100		
Spot export area	200					100							
Call export area	100												
Sacramento		*33.334*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*100*	*100*	*100*	*75*	*50*	*25*	*0*	*0*
Cost of Purchases		*2*	*0*	*0*	*0*	*20*	*0*	*0*	*0*	*0*	*12*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*8*	*8*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*1.5*											
Financial Balance		*50.4*	*50.425*	*50.425*	*50.425*	*30.425*	*30.425*	*30.425*	*22.425*	*14.425*	*2.425*	*2.425*	*2.425*
Approximate Water Buying Power		*98.55*	*98.55*	*98.55*	*98.55*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*33.334*	*0.001*	*0.001*	*0.001*	*100.001*	*100.001*	*100.001*	*75.001*	*50.001*	*25.001*	*0.001*	*0.001*

Summary

1991	1992	1993
200	200	300
170	160	241
45	45	45
0	0	25
0	0	0

Water Quality purchases
amount cfs
amount TAF

Water Quality Optior TAF 90TAF
cost $m 8.1m

water quality call on options TAF 30
cost $m

Releases for water quality
Balance

D-017121

GAME 2 Water 1994 Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*-20*	*20*
Sacramento River Market Releases												50	17
San Joaquin River Market Releases								60		40			
Delta Cross Channel Closed?													
Bacon Island Diversions													
Pumping from/to Bacon to/from CCFB		*-120*	*0*	*0*	*-80*	*0*	*17*	*56*	*0*	*108*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island						120							
Release for export											60		60
Change in CCFB/Tracy Diversions		*48*	*3.11*	*-117*	*230*	*40*	*-17*	*-52*	*4*	*-116*	*60*	*28*	*95*
Total Change in Delta Diversions		*48*	*3.11*	*-117*	*230*	*160*	*-17*	*-52*	*4*	*-116*	*60*	*28*	*95*
Water Generated by E/I Relaxations		45	0	0	0	0	0	0	0	0	0	0	0
Carriage Water												6	7
Change in Delta Outflow		*-48*	*-3.11*	*117*	*-230*	*-160*	*17*	*112*	*-4*	*156*	*-60*	*2*	*-58*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Efficiency/ET													
Change Groundwater Storage		*40*	*0*	*40*	*40*	*40*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*-112*	*3.11*	*-157*	*110*	*0*	*0*	*4*	*4*	*-8*	*0*	*28*	*35*
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Increased deliveries		0	0										
Upstream Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	190	40	0	0	0	0	0	0
EWA Shasta		0	0	0	0	0	0	0	0	0	0	20	0
Bacon Storage		120	120	120	200	200	183	127	127	19	19	19	19
SemiTropic	200	60	60	60	60	80	80	80	80	80	80	80	80
Kern	100	50	50	70	90	100	100	100	100	100	100	100	100
Gravelly Ford	100	50	50	70	90	100	100	100	100	100	100	100	100
EWA San Luis		43.89	47	-110	0	0	0	4	8	0	0	28	63
Borrowed MWD													
Year Type: 1 for dry/critical. 0 otherwise		*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10	100											
Option San Joaquin	10	100											
Option Export	10												
Spot Sacramento	200												
Call Sacramento	60							100					
Spot San Joaquin	200												
Call San Joaquin	60							100					
Spot export area	200												
Call export area	100												
Sacramento		*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*100.001*	*100.001*	*100.001*	*100.001*	*50.001*	*33.001*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*40*	*40*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*18*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*1.4*											
Financial Balance		*33.8*	*33.8296*	*33.8296*	*33.8296*	*33.8296*	*33.8296*	*15.8296*	*15.8296*	*15.8296*	*15.8296*	*15.8296*	*15.8296*
Approximate Water Buying Power		*70.9775*	*70.9775*	*46.9775*	*22.9775*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*140.001*	*140.001*	*100.001*	*100.001*	*50.001*	*33.001*

Summary

1991	1992	1993
200	200	300
170	160	241
45	45	45
0	0	25
0	0	0

Water Quality purchases

amount	*cfs*		
amount	TAF		90

Water Quality Optior TAF

	cost $m		
water quality call on options	TAF		30
	cost $m		

Releases for water quality		30
Balance		

D-017122

GAME 2 — Water 1995 — Values in italics are calculated

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Change in Shasta Releases	*0*	*0*	*0*	*-50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Sacramento River Market Releases	17	17												
San Joaquin River Market Releases														
Delta Cross Channel Closed?														
Bacon Island Diversions														
Pumping from/to Bacon to/from CCFB	*0*	*0*	*19*	*0*	*-120*	*0*	*60*	*60*	*0*	*-200*	*0*	*0*		
Webb Tract Diversions														
Diversion to Island				60	60									
Release for export														
Change in CCFB/Tracy Diversions	*18*	*83*	*-107*	*-340*	*384*	*20*	*4*	*4*	*-446*	*204*	*4*	*4*		
Total Change in Delta Diversions	*18*	*83*	*-107*	*-280*	*444*	*20*	*4*	*4*	*-446*	*204*	*4*	*4*		
Water Generated by E/I Relaxations	0	65	37	0	0	0	0	0	0	0	0	0		
Carriage Water														
Change in Delta Outflow	*-1*	*-66*	*107*	*230*	*-444*	*-20*	*-4*	*-4*	*446*	*-204*	*-4*	*-4*	*0*	*0*
South of Delta market "deliveries"														
MWD Shift Water to/from EWA														
Efficiency/ET														
Change Groundwater Storage	*0*	*0*	*0*	*0*	*0*	*20*	*20*	*0*	*0*	*20*	*20*	*20*		
Change in San Luis Storage	*16*	*83*	*-88*	*-340*	*264*	*0*	*44*	*64*	*-446*	*-16*	*-16*	*-16*		

End of Month Values for EWA Accounts	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Increased deliveries													
Upstream Surplus Capture		0	0	0	50	0	0	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	364	20	0	0	0	200	0	0
EWA Shasta		0	0	0	50	50	50	50	50	50	50	50	50
Bacon Storage		19	19	0	0	120	120	60	0	0	200	200	200
SemiTropic	200	80	80	80	80	80	100	120	120	120	140	160	180
Kern	100	100	100	100	100	100	100	100	100	100	100	100	100
Gravelly Ford	100	100	100	100	100	100	100	100	100	100	100	100	100
EWA San Luis		81	164	76	-264	0	0	44	108	-338	-354	-370	-386
Borrowed MWD													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Option Sacramento	10	100											
Option San Joaquin	10	100											
Option Export	10												
Spot Sacramento	200												
Call Sacramento	60												
Spot San Joaquin	200												
Call San Joaquin	60												
Spot export area	200												
Call export area	100												
Sacramento		*16.001*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Purchases		*2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*1.2*											
Financial Balance		*45.1*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*
Approximate Water Buying Power		*54.4264*	*54.4264*	*54.4264*	*54.4264*	*54.4264*	*30.4264*	*6.42638*	*6.42638*	*6.42638*	*0*	*0*	*0*
Sum of undelivered Purchases		*16.001*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*

Summary

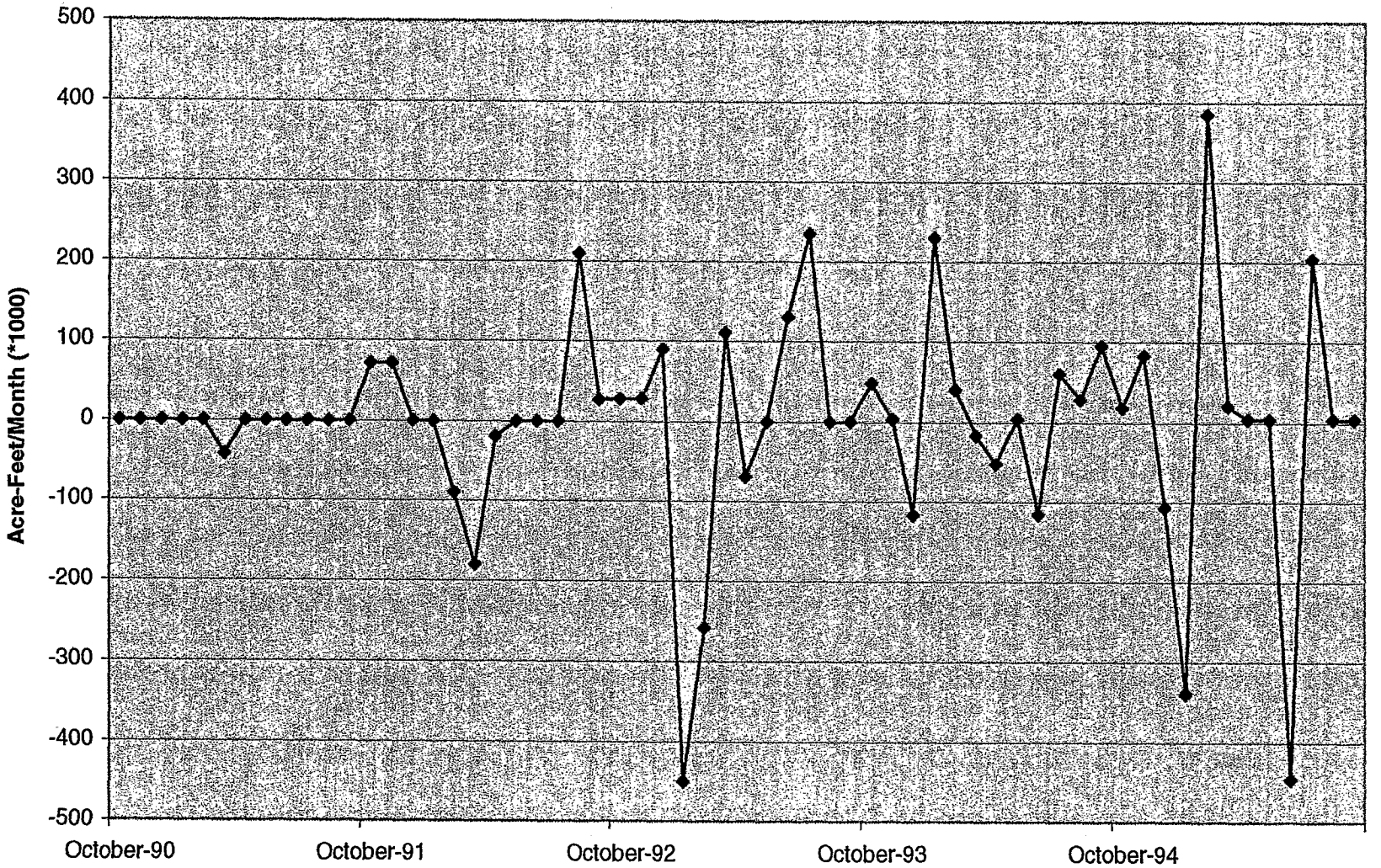
1991	1992	1993
200	200	300
170	160	241
45	45	45
0	0	25
0	0	0

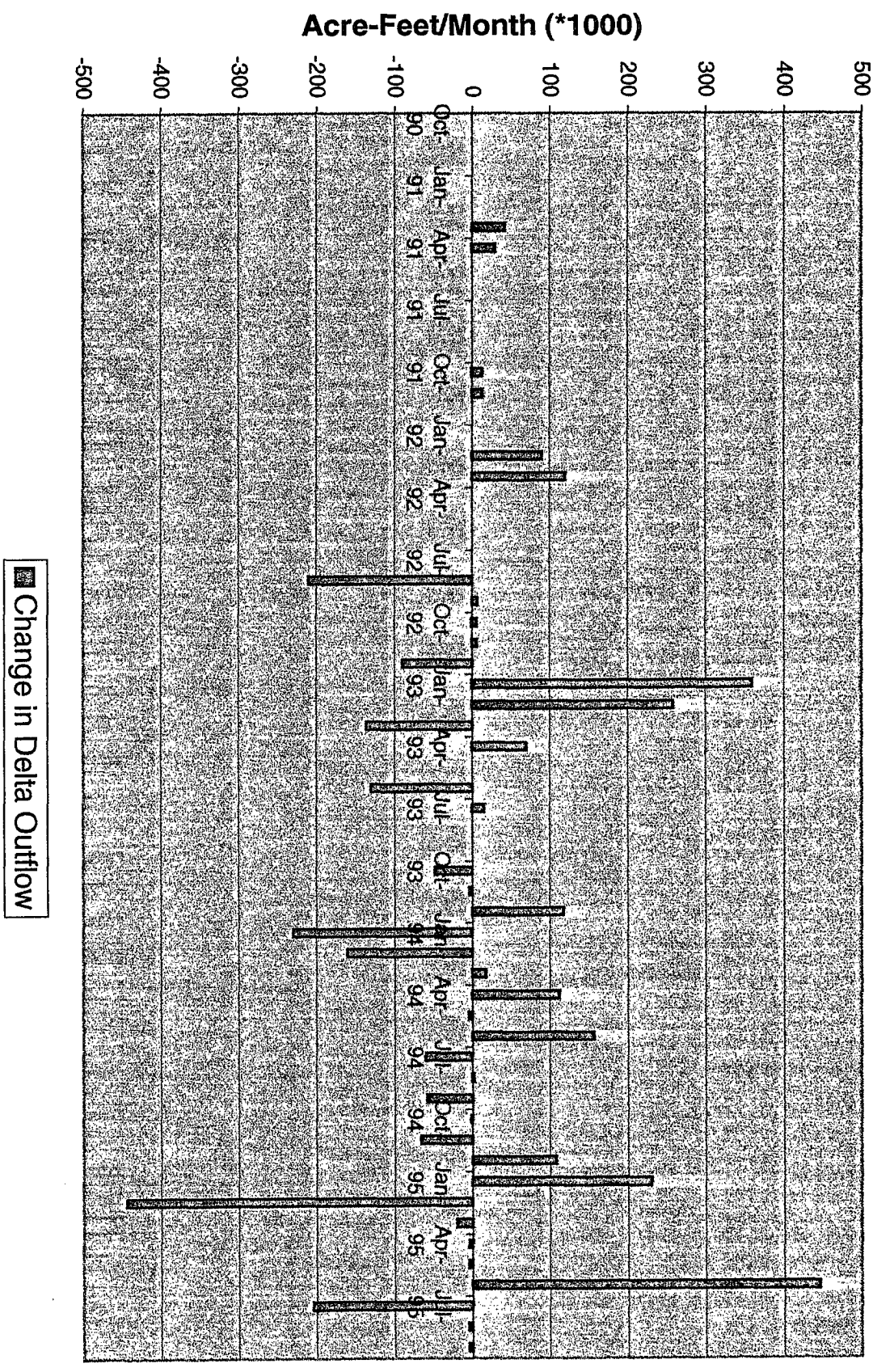
Water Quality purchases
amount cfs
amount TAF 90

Water Quality Optior TAF
cost $m
water quality call on options TAF
cost $m

Releases for water quality 30
Balance

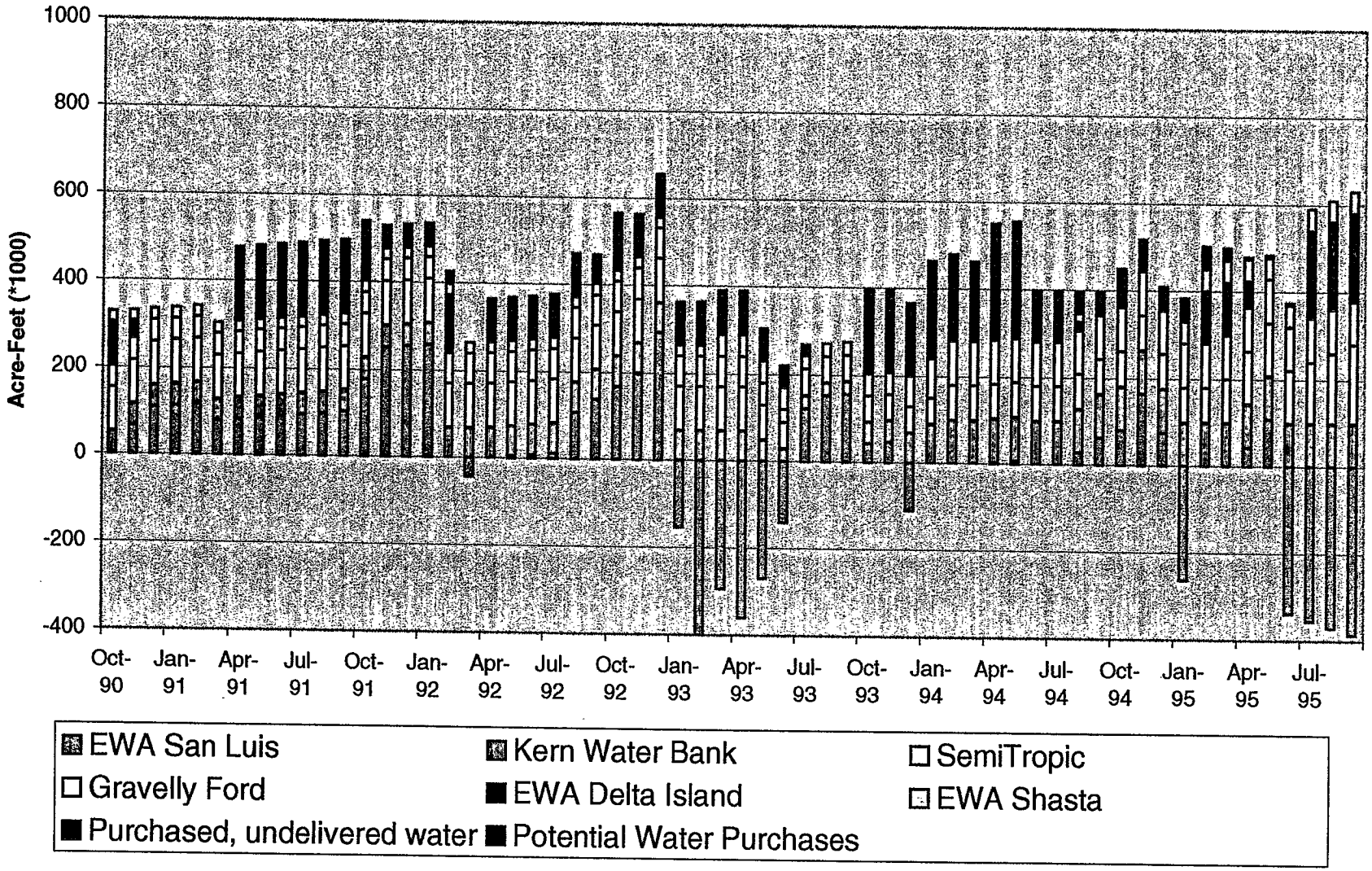
Change In Clifton Court/ Tracy Pumping
March 1999 EWA Game




Acre-Feet/Month (*1000)
500
400
300
200
100
0
-100
-200
-300
-400
-500
Oct-90
Jan-91
Apr-91
Jul-91
Oct-91
Jan-92
Apr-92
Jul-92
Oct-92
Jan-93
Apr-93
Jul-93
Oct-93
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
Apr-95
Jul-95
Change in Delta Outflow
Change in Delta Outflow

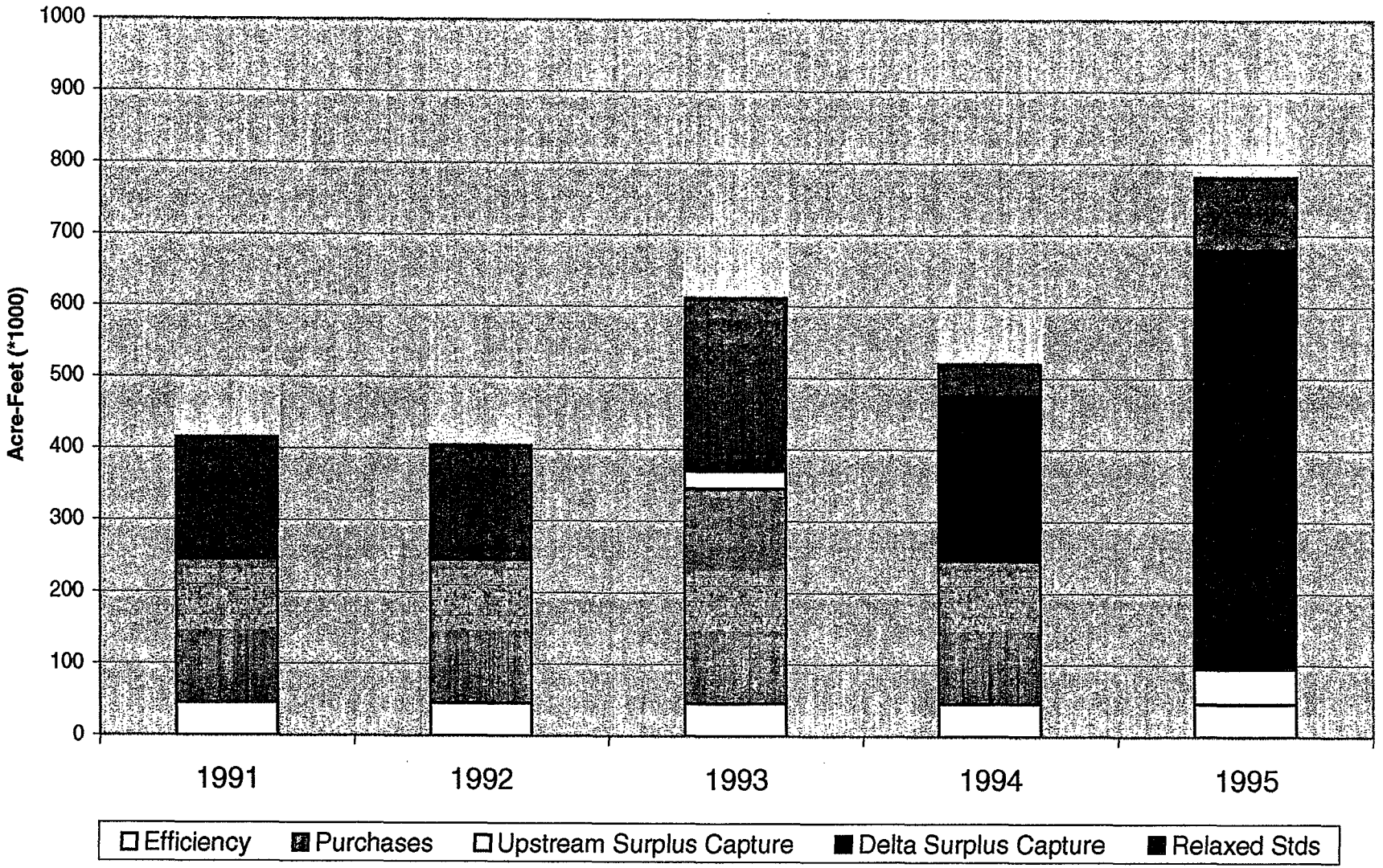
D-017125

EWA Assets
Game 2



D—017126

EWA Water Sources
Game 2



GAMEZ

Reconstruction	*Water Year*		1991	Values in italics are calculated									
		IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases			0											
San Joaquin River Market Releases			0						30					
Delta Cross Channel Closed?														
Bacon Island Diversions														
Pumping from/to Bacon to/from CCFB			*0*	*60*	*40*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions														
Diversion to Island														
Release for export						60								
Change in CCFB/Tracy Diversions			*0*	*0*	*0*	*0*	*0*	*-42*	*0*	*0*	*0*	*0*	*0*	*0*
Total Change in Delta Diversions			*0*	*0*	*0*	*60*	*0*	*-42*	*0*	*0*	*0*	*0*	*0*	*0*
Divert for EWA from Store/buy, surplus			0											
E/I relaxation														
Carriage Water														
Change in Delta Outflow			*0*	*0*	*0*	*0*	*0*	*42*	*30*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"			0											
MWD Shift Water to/from EWA														
Efficiency/ET			3	3	3	4	4	4	4	4	4	4	4	4
Change Groundwater Storage			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage			*3*	*63*	*43*	*4*	*4*	*-38*	*4*	*4*	*4*	*4*	*4*	*4*
End of Month Values for EWA Accounts			0											
	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		25	25	25	25	25	25	25	25	25	25	25	25	25
Bacon Storage		100	100	40	0	0	0	0	0	0	0	0	0	0
SemiTropic	200	100	100	100	100	100	100	100	100	100	100	100	100	100
Kern	100	50	50	50	50	50	50	50	50	50	50	50	50	50
Gravelly Ford	100	50	50	50	50	50	50	50	50	50	50	50	50	50
EWA San Luis		0	3	66	109	113	117	79	83	87	91	95	99	103
Borrowed MWD		0												
increased deliveries									0	0	60	20	0	0
Purchased	*$/af dry adder*													
Year Type: 1 for dry/critical. 0 otherwise			*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10	10	100											
Option San Joaquin	10	10	100											
Option Export	10	10												
Spot Sacramento	200	100												
Call Sacramento	60	30							100					
Spot San Joaquin	200	100												
Call San Joaquin	60	30							100					
Spot export area	200	100												
Call export area	100	50												
Purchased but undelivered														
Sacramento		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*100*	*100*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*70*	*70*	*70*	*70*	*70*	*70*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*170*	*170*	*170*	*170*	*170*	*170*
Cost of Purchases			*2*	*0*	*0*	*0*	*0*	*0*	*18*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA			*30*											
Interest														
Financial Balance		*0*	*28*	*28*	*28*	*28*	*28*	*28*	*10*	*10*	*10*	*10*	*10*	*10*
Approximate Water Buying Power after pumping costs		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Water Quality purchs millions			3											
amount cfs			500											
amount TAF			32											
Water Quality Optior TAF					90									
cost $m					1.8									
water quality call on options	TAF								90					
	cost $m								1.8					
Releases for water quality													30	30
Balance													60	30

D—017128

D-017128

Reconstruction **Water 1992** *Values in italics are calculated*

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases		50	50										33.333
San Joaquin River Market Releases		35	35				60	40					
Delta Cross Channel Closed?													
Bacon Island Diversions								60					
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*-133*	*133*	*60*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island						0	120						
Release for export												120	
Change in CCFB/Tracy Diversions		*71.5*	*71.5*	*0*	*0*	*-90*	*-180*	*-20*	*0*	*0*	*0*	*210*	*26.63*
Total Change in Delta Diversions		*71.5*	*71.5*	*0*	*0*	*-90*	*-60*	*40*	*0*	*0*	*0*	*210*	*26.63*
Divert for EWA from Store/buy, E/I relaxation													
Carriage Water		13.5	13.5										6.67
Change in Delta Outflow		*13.5*	*13.5*	*0*	*0*	*90*	*120*	*0*	*0*	*0*	*0*	*-210*	*6.703*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Efficiency/ET		3	3	3	4	4	4	4	4	4	4	4	4
Change Groundwater Storage		*0*	*0*	*0*	*0*	*40*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*74.5*	*74.5*	*3*	*4*	*-259*	*-43*	*44*	*4*	*4*	*4*	*94*	*30.63*

End of Month Values for EWA Accounts

	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		25	25	25	25	25	25	25	25	25	25	25	25
Bacon Storage		0	0	0	0	133	0	0	0	0	0	0	0
SemiTropic	200	100	100	100	100	100	100	100	100	100	100	100	100
Kern	100	50	50	50	50	70	70	70	70	70	70	70	70
Gravelly Ford	100	50	50	50	50	70	70	70	70	70	70	70	70
EWA San Luis		177.5	252	255	259	0	-43	1	5	9	13	107	137.63
Borrowed MWD													
increased deliveries													
Purchased	*$/af*												
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10	100											
Option San Joaquin	10	100											
Option Export	10												
Spot Sacramento	200												
Call Sacramento	60							100					
Spot San Joaquin	200							0					
Call San Joaquin	60						60	40					
Spot export area	200												
Call export area	100												
Purchased but undelivered													
Sacramento		*50*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*100*	*66.667*
San Joaquin		*35*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*85*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*100*	*66.667*
Cost of Purchases		*2*	*0*	*0*	*0*	*0*	*5.4*	*12.6*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*1.0*											
Financial Balance		*39.0*	*38.95*	*38.95*	*38.95*	*38.95*	*33.55*	*20.95*	*20.95*	*20.95*	*20.95*	*20.95*	*20.95*
Approximate Water Buying Power after pumping costs		*53.7*	*53.7*	*53.7*	*53.7*	*29.7*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Water Quality purch: millions		3											
amount	cfs	500											
amount	TAF	32											
Water Quality Optior TAF							90TAF						
cost $m							8.1m						
water quality call on options	TAF			90								30	30
	cost $m			1.8									
Releases for water quality		30											
Balance		0											

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Reconstruction Water 1993 Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*-25*	*0*	*0*	*0*	*50*	*0*	*0*
Sacramento River Market Releases		33.333	33.333								100		
San Joaquin River Market Releases											100		
Delta Cross Channel Closed?													
Bacon Island Diversions													
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island					90	0							
Release for export										90			
Change in CCFB/Tracy Diversions		*27.63*	*27.63*	*90*	*-450*	*-258*	*111*	*-70*	*0*	*130*	*235*	*0*	*0*
Total Change in Delta Diversions		*27.63*	*27.63*	*90*	*-360*	*-258*	*111*	*-70*	*0*	*130*	*235*	*0*	*0*
Divert for EWA from Store/buy, E/I relaxation													
Carriage Water		6.67	6.67								15		
Change in Delta Outflow		*5.703*	*5.703*	*-90*	*360*	*258*	*-136*	*70*	*0*	*-130*	*15*	*0*	*0*
South of Delta market "deliveries"									25	25	25	25	
MWD Shift Water to/from EWA													
Efficiency/ET		3	3	3	4	4	4	4	4	4	4	4	4
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*-60*	*-60*	*0*	*0*	*0*
Change in San Luis Storage		*30.63*	*30.63*	*93*	*-446*	*-254*	*115*	*-66*	*89*	*129*	*264*	*29*	*4*

End of Month Values for EWA Accounts

	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		25	25	25	25	25	50	50	50	50	0	0	0
Bacon Storage		0	0	0	0	0	0	0	0	0	0	0	0
SemiTropic	200	100	100	100	100	100	100	100	80	60	60	60	60
Kern	100	70	70	70	70	70	70	70	50	30	30	30	30
Gravelly Ford	100	70	70	70	70	70	70	70	50	30	30	30	30
EWA San Luis		168.26	198.89	291.89	-154.11	-408.11	-293.11	-359.11	-270.11	-141.11	122.89	151.89	155.89
Borrowed MWD													
Increased deliveries								20	120	0	160	0	0
Purchased	*$/af*												
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Option Sacramento	10	100											
Option San Joaquin	10	100											
Option Export	10												
Spot Sacramento	200												
Call Sacramento	60										100		
Spot San Joaquin	200												
Call San Joaquin	60										100		
Spot export area	200					100							
Call export area	100												
Purchased but undelivered													
Sacramento		*33.334*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*100*	*100*	*100*	*75*	*50*	*25*	*0*	*0*
Sum of undelivered Purchases		*33.334*	*0.001*	*0.001*	*0.001*	*100.001*	*100.001*	*100.001*	*75.001*	*50.001*	*25.001*	*0.001*	*0.001*
Cost of Purchases		*2*	*0*	*0*	*0*	*20*	*0*	*0*	*0*	*0*	*12*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*8*	*8*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*1.5*											
Financial Balance		*50.4*	*50.425*	*50.425*	*50.425*	*30.425*	*30.425*	*30.425*	*22.425*	*14.425*	*2.425*	*2.425*	*2.425*
Approximate Water Buying Power after pumping costs		*98.55*	*98.55*	*98.55*	*98.55*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Water Quality purche millions
amount cfs
amount TAF

Water Quality Optior TAF 90TAF
cost $m 8.1m

water quality call on options TAF 30
cost $m

Releases for water quality
Balance

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Reconstruction Water 1995 Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Change in Shasta Releases		*0*	*0*	*0*	*-50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Sacramento River Market Releases		17	17												
San Joaquin River Market Releases															
Delta Cross Channel Closed?															
Bacon Island Diversions															
Pumping from/to Bacon to/from CCFB		*0*	*0*	*19*	*0*	*-120*	*0*	*60*	*60*	*0*	*-200*	*0*	*0*		
Webb Tract Diversions															
Diversion to Island					60	60									
Release for export															
Change in CCFB/Tracy Diversions		*18*	*83*	*-107*	*-340*	*384*	*20*	*4*	*4*	*-446*	*204*	*4*	*4*		
Total Change in Delta Diversions		*18*	*83*	*-107*	*-280*	*444*	*20*	*4*	*4*	*-446*	*204*	*4*	*4*		
Divert for EWA from Store/buy, E/I relaxation															
Carriage Water															
Change in Delta Outflow		*-1*	*-66*	*107*	*230*	*-444*	*-20*	*-4*	*-4*	*446*	*-204*	*-4*	*-4*	*0*	*0*
South of Delta market "deliveries"															
MWD Shift Water to/from EWA															
Efficiency/ET															
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*20*	*20*	*0*	*0*	*20*	*20*	*20*		
Change in San Luis Storage		*18*	*83*	*-88*	*-340*	*264*	*0*	*44*	*64*	*-446*	*-16*	*-16*	*-16*		
End of Month Values for EWA Accounts															
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
EWA Shasta		0	0	0	50	50	50	50	50	50	50	50	50		
Bacon Storage		19	19	0	0	120	120	60	0	0	200	200	200		
SemiTropic	200	80	80	80	80	80	100	120	120	120	140	160	180		
Kern	100	100	100	100	100	100	100	100	100	100	100	100	100		
Gravelly Ford	100	100	100	100	100	100	100	100	100	100	100	100	100		
EWA San Luis		81	164	76	-264	0	0	44	108	-338	-354	-370	-386		
Borrowed MWD															
Increased deliveries															
Purchased	*$/af*														
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Option Sacramento	10	100													
Option San Joaquin	10	100													
Option Export	10														
Spot Sacramento	200														
Call Sacramento	60														
Spot San Joaquin	200														
Call San Joaquin	60														
Spot export area	200														
Call export area	100														
Purchased but undelivered															
Sacramento		*16.001*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*		
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Sum of undelivered Purchases		*16.001*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*	*-0.999*		
Cost of Purchases		*2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Payments to EWA		*30*													
Interest		*1.2*													
Financial Balance		*45.1*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*	*45.0711*		
Approximate Water Buying Power after pumping costs		*54.4264*	*54.4264*	*54.4264*	*54.4264*	*54.4264*	*30.4264*	*6.42638*	*6.42638*	*6.42638*	*0*	*0*	*0*		
Water Quality purchs millions															
amount cfs															
amount TAF			90												
Water Quality Optior TAF															
cost $m															
water quality call on options	TAF														
	cost $m														
Releases for water quality		30													
Balance															

Game 2: 1991

1. New screens at south Delta pumping plants.
2. Gravelly Ford and Webb not in model. Kern in model will be proxy for Gravelly Ford, which will not be operated in the game.
3. Water quality has $3 million to purchase water or delay pumping.
4. Groundwater assumed available is 20, 20, 20 TAF.(Kern, Gravelly, and Semitropic). Only 20 TAF used in EWA gaming.
5. New base assumptions. - Study 834
6. Water quality will be included in real time.

October	Pumping limited by outflow limits. Monthly export is 3301; daily was 3600; Outflow was 5447; E/I was 0.32 ; X2 was 85.7. EWA : nothing to do. Buy future options from upstream and possibly downstream. 200 TAF option purchase. WQ: purchase $3m for outflow or 500 cfs for the month.
November	Pumping limited by outflow limits. Monthly export is 5000; Outflow was 3500; E/I was 0.52 ; X2 was 87.8. Pumped 60 TAF from Bacon to San Luis EWA. Could have taken all 100 TAF. That's all.
December	Exports at 5k, outflow at 3500. E/I at .53; X2=88. Poor water quality of export water. Pump 40 TAF from Bacon. 90TAF for WQ options. E/I limiting part of month. That's all.
January	Pumping limited by outflow limits. Monthly export is 3901 Outflow was 4700; E/I was 0.44 ; X2 was 86.
February	Exports 976/4,000; outflow 12k; E/I = 7%; X2 =79; meeting intial Feb X2 requirement. High TOC in the early flow pulse. Could influence X2 if we exported the flow pulse. That's all.
March	Exports 12,700, Outflow 24k, E/I =35%, X2 = 70.7. E/I limiting. We could pump the spike of water, especially given new screens. Monitoring would be key to determining whether we relax E/I. We assumed that monitoring had yet to detect salmon early in March. So we relaxed E/I for 7 days and pumped new EWA water (170 TAF) directly into San Luis, but then we became worried about indirect effects of relaxing E/I and fish salvage in later 3 weeks of month. Assuming that X2 benefits earlier would have kept smelt downstream. Also put more TOC in with extra water pumped, but also benefited water quality with lower X2. (Set fish trigger at 20 salmon and steelhead at 5 relaxed E/I.) Lost TAF in EWA in San Luis from fish triggers in last three weeks.
April	Exports 4k, outflow 14k , E/I = .2, X2 = 72. E/I limited. VAMP in latter half. Called 100 TAF from San Joaquin and Sacramento (commitment for the summer delivery). Can't back this into Shasta because of minimum releases from Keswick and temp problems. Probably from Yuba. WQ called its options (north of Delta to be used as outfall in fall). Extend VAMP outflow SJ for first two weeks of month but kept exports up to 15

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	kcfs in early April. Cost of 30 TAF for this additional SJ flow.
May	Exports = 2160; outflow = 7024; E/I 19%; X2 = 78. VAMP restriction in early May. That's all.
June	Model Exports = 217; outflow = 5930; E/I = 2%; X2 = 81. X2 restrictions. Difficult to speculate where smelt are, thus hold water til next water year. May have spent some water for outflow in early June.
July	Tried to sell EWA water during summer for $250-300/AF.
August	That's all. Released 30TAF for water quality.
September	That's all Released 30TAF for water quality.
Yearly totals	

Game 2: 1992

October	Exports=3k; outflow =5.5; E/I =31%/ X2= 86. Buy options. Outflow limiting exports. Outflow could be lower if September releases for WQ benefited X2, thus more water available for exports. Keep incidental benefits to keep WQ high. No biological actions. Released 830 cfs out of Yuba, 580 from San Joaquin. Lost 250 cfs to carriage water. The rest to San Luis. Released 500 cfs for WQ outflow. Total of 1850 cfs extra inflow, and 500 cfs outflow.
November	Released 830 cfs out of Yuba, 580 cfs from San Joaquin. Lost 250 cfs to carriage water.
December	Exports = 4256; outflow = 3500, E/I = 48%, X2 =88. Critical conditions. Need to think about getting X2 down to 81. That's all.
January	Exports = 8457, outflow = 4700, E/I =65%, X2 = 86.4. E/I limiting in early January thus allowing some EWA pumping to storage, but with 81 X2 near limiting, then projects would not move EWA water. No actions.
February	Exports = 10,898, outflow = 28,116, E/I =29%, X2 = 72. E/I limiting. Put 60TAF of project water onto Webb. Bromides low; TOC high. Initially allow relaxing E/I to outflow limits for first week. Then use triggers last three weeks. Salmon trigger set at 50. Gain was 40 TAF use of 130TAF , net loss of 90 TAF from San Luis. 40 into gw from SL. Constraints on DW from delta smelt distribution. Pumped SL into gw and Bacon. Cost of restricting pumping from salmon triggers cost 130 and 40 gained = net 90. Carrying debt of 30 on Webb in event it fills. Some WQ money could be spent on source control because of high TOC.
March	Exports = 8227, outflow = 15138, E/I =35%, X2 = 72. E/I limiting, except for first week when outflow was controlling. San Joaquin option of 1,000 cfs for 30 days. Shifting exports to Webb - waving BO restrictions. 90 TAF of EWA on Webb, projects have 30 on Webb. Paid our debt of 30 on Webb, because the first 30 TAF diverted to Webb paid off paper EWA was holding. Now square on debts. Also reduced exports 1,000 cfs for month to help reduce export impacts. Webb EWA should be used before projects refill it with nexst opportunity.
April	Exports = 3000, outflow = 10567, E/I =20%, X2 = 75. WQ commits to its options 90TAF. Shift 1000 cfs export pumping to Bacon to reduce loss of salmon at export pumps to handling. (Note: HOR could have lessened impacts on SJ salmon.) Webb EWA is empty, but 60 TAF of project water put on island this month. No further actions.
May	Exports = 1026, outflow = 7301, E/I =9%, X2 = 78.5. VAMP continues with reduced exports. Options: Use Webb water for increasing X2 and QWEST or wait till summer to move to San Luis. No actions decided.
June	Exports = 1080, outflow =6199, E/I =11%, X2 = 81. Webb can't be

	released until July. Assumed delta smelt would not have salvage losses as high as historical. No actions decided.
July	Exports = 1080, outflow =4000, E/I =11%, X2 = 82. Tradeoff between fish and WQ when considering to releasing Webb water. Better WQ in July but Webb water may have better quality. This tradeoff between fish and WQ would be covered on a real time basis. Helping San Luis through low point and helping WQ.
August	WQ releasing 30TAF / 500cfs to outflow. Moving 120 TAF from Webb to SL (30 projects/90 EWA); helps with low point in San Luis.
September	WQ releasing 30TAF / 500cfs to outflow. Move Sac (Yuba) EWA option water to SL (33.3-6.7=26.6TAF). Carriage water from moving Sac options to San Luis (6.7TAF) will benefit WQ and fish.

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Game 2: 1993

October	Exports = 4000, outflow 5500, E/I 38%, X2 86. Chlorides at 250. Move Sac (Yuba) water to SL. Carriage from moving Sac options to San Luis (6.7TAF) will benefit WQ and fish. Exercise 30 TAF for WQ. Buy new options for EWA 100/100. No actions.
November	Exports=4800, outflow 3500, E/I 51%, X2 88.Move Sac (Yuba) water to SL. Carriage from moving Sac options to San Luis (6.7TAF) will benefit WQ and fish. Outflow limiting
December	Exports = 11161, outflow 6100, E/I 65%, X2 84. Export limiting in first half and outflow limiting in last half. Monthly model exports are unrealistically too high and SL is filling unrealistically too fast. First major storm of the year. Worry about WQ with new DOC, but could improve WQ. Relax E/I first two weeks and reduce exports in latter half to provide a net gain of 90 TAF for EWA in San Luis. Change in exports caused us not to be able to fill Delta islands.
January	Exports = 14500, outflow 55000, E/I 23%, X2 66. Could put in Webb with 90TAF (three weeks at 2000 cfs). Reduced total exports to 7500 including Webb diversion. Loss of 450,000 TAF from San Luis account.
February	Exports = 14500, outflow 46000, E/I 25%, X2 61. Roe island standard limiting exports in early Feb. But Roe would have benefited from last month's higher outflow. Concerned about winter run take, thus restricted exports by 258TAF to 7500. Purchased 100 TAF on spot market from EWA.
March	Exports = 11000, outflow 32000, E/I 26%, X2 63. Outflow limiting early in month as flows recede. E/I is limiting in latter half of the month; thus allowing relaxation for EWA. Can't use Bacon screens because of ds BO. Real time monitoring is assumed to show minimal potential impacts based on salvage surrogate. Picked up 111TAF for EWA in San Luis by relaxing EWA.
April	Exports = 8200, outflow 38200, E/I 17%, X2 62. Limited by pumping capacity, but projects refilling SL with 15,000 cfs exports during the first two weeks. Then VAMP takes over with 1,500. Cut to 10,000 cfs export in second week, but run 4,000 cfs through Bacon complex. Cost of 70TAF.
May	Exports =5000, outflow 29000, E/I 14%, X2 64. Use 25TAF from spot market plus 60 TAF from GW to reduce San Luis debt. Otherwise VAMP is controlling. DW is shutdown by BO.
June	Exports =12441, outflow 19000, E/I 35%, X2 67. Pumping capacity controls in early month. E/I is controlling in latter half. Provided 40TAF of EWA for San Luis. Pumped 60TAF from GW to pay debt. 25

	TAF delivered south of Delta from spot market purchases.
July	Exports =5500, outflow 8000, E/I 30%, X2 75. Outflow is limiting. Make calls on water. Stop pumping gw. 25 TAF delivered south of Delta from spot purchases. Exports increased from 5 in model to near 15kcfs.
August	Exports =13500, outflow 4000, E/I 65%, X2 65. Outflow limiting. No action. 25 TAF delivered south of Delta from spot purchases.
September	Exports =10300, outflow 3300, E/I 65%, X2 87. Outflow limiting. No action.

Game 2: 1994

October	Exports 13000, outflow 5600, E/I 65%, X2 85 Buy 100 k of Sac Options, E/I relaxed 45K backup onto Bacon. Another 75 TAF from SL back onto Bacon. 40 TAF into GW for EWA. No other actions.
November	Exports 10000, outflow 4500, E/I 65%, X2 86 No actions.
December	Exports 12600, outflow 5800, E/I 65, X2 84 San Luis is filling. Cut exports to 5000 cfs for fish in last three weeks. Cost of 120 TAF. 40 TAF into GW borrowed from SL.
January	Exports 9229, outflow 10000, E/I 49%, X2 79. Cut exports to 5000 for first week and 7000 last three weeks. Put 80TAF onto Bacon, put 40 into GW from San Luis. Daily model does not show these exports.
February	Exports at 6000, outflow at 26000, E/I 20, X2 at 70. Filled webb 120 TAF, 40 TAF into GW. Daily model does not show these exports.
March	Exports 5200, outflow 10800, E/I 30, X2 74. Curtail exports to 4000 cfs all month. Cost of 17 TAF out of Bacon. No other actions.
April	Exports 2873, outflow 8550, E/I 22%, X2 77. Augment SJ flow in first two weeks by 2000 cfs. Cut exports to 3000 cfs for first two weeks cost of 60 TAF.
May	Exports 2100, outflow 8000, E/I 17%, X2 79. High salvage of smelt should be helped by improved San Joaquin flows and lower exports under VAMP. NO other actions needed.
June	Exports 5900, outflow 6200, E/I 35%, X2 81 E/I limiting. Increase SJ flows by 40 TAF for fish. Can't move Webb water to San Luis. Could trade Bacon for Webb water for right price. Cut exports to ramp flows by limiting exports to 1500 in first week and 2500 the second, 3500 third, 4500 fourth for a cost of 120 TAF. Higher exports in June would take more smelt, but we have already helped them with extra SJ flow in May and 600 cfs of SJ in June, plus the further benefit of lower X2, as well as the export ramping.
July	Exports 5900, outflow 4000, E/I 40%, X2 85. AFRP provides some protection by limiting exports. Released 60 TAF from Webb and increased exports by 2000 cfs last two weeks – relaxed AFRP Action#7 to do this.
August	Exports 11824, outflow 2992, 65%, X2 89 WQ took 30TAF from Yuba for outflow. Backup 20 TAF to shasta, 30TAF from yuba with 24 to SL.
September	Exports 6300, outflow 3000, E/I 55%, X2 at 90.

	Move 17 from Sac to SL. Released 20 from Shasta. Moved to SL.

Game 2: 1995

October	Exports 5100, outflow 4000, E/I 48%, X2 81+, Smelt index is low, pop centered around Decker Is. Winter run 200, spring run 1500. No salmon problems of note. Purchase surface water options to avoid gw pumping costs. Good deal for water options, but dubious of real availability. 750 cfs released from Sac reservoirs for water quality and transfer to San Luis. Concern that these will cause salmon spawning in shallows that will later be dewatered as flows decline after transfers. Could have pulled Sac water earlier and parked it on Webb, however high X2 would limit Webb diversions.
November	Exports 6000, outflow 6000, E/I 51%, X2 85. Dsmelt index 500+, no salmon problems. 750 cfs released from Sac reservoirs for water quality and transfer to San Luis. Available water for EWA pumping would impact water quality..... Agreed to relax E/I and set export limits at 10,000 cfs.....Potentially unrealistic cooperative solution between WQ and Fish. Gained 65TAF for EWA in San Luis.
December	Exports 7500, outflow 9800, E/I 42%. X2 moving down from 80+ First pulse of Sac water of 30kcfs in first week of month. Relax E/I first week, max at 10. Second week no action. Three and four weeks hold to 7000 export. Pick up 37 TAF but cost 147 TAF.
January	Exports 11600, outflow 105,600, E/I 20, X2 55. Smelt low exports and index is lowest on record (index = 101), winter run, spring run, and late fall salmon being salvaged and splittail adults in small numbers. Fill ½ Webb and Bacon complex. Limit exports to 10 kcfs for smelt and salmon, cost of 224 TAF from San Luis. Use 2000 of 10000 in last two weeks of exports to Webb (60 TAF).
February	Exports 6500/15000, outflow 129000, E/I 6, X2 50?. Fill Webb immediately. Fill Bacon 120TAF in first two weeks. Pump new 15000 cfs compared to 6500 cfs; assumed higher exports don't increase density in the South Delta. (Note historic demands were lower than daily model, which leads to San Luis filling later than DWRSIM. DWRSIM has demands of 4m, while daily model has demand of 6 m. We need realistic demands in the model.)
March	Exports 2800/15000, outflow 178,000, E/I 4%, X2 50? No actions, but there is a lack of historic salvage data because there were no exports. Again concern for high exports (15000). Moved 20 TAF to Semitropic.
April	Exports 3400, 91000, 4%, X2 50? Moved 20 TAF to Semitropic.. Passed on options and moved Bacon 60 TAF to San Luis.

May	Exports 4200, outflow 100,000, E/I = 4%, X2 Moved 20 TAF to Semitropic. Moved 60 TAF from Bacon to San Luis.
June	Exports 4200, outflow 100,000, E/I = 4%, X2 Moved 20 TAF to Semitropic. Splittail salvage high in early June. But we have new screens in place. First week cut exports to 3000. Second week 4500. Third week is 6000. Fourth week is 15000. Total hits is 450 TAF, because account has no access to first 15,000 cfs of 21,000 total capacity. Option not called in.
July-September	Exports at 15,000. Put 200 TAF onto Bacon with upper 6000 out of 21000 in July.
August	
September	

D-017141

GAME 2 – BIOLOGICAL

RULES

- Similar to Game 1
- Joint point
- Projects get 200 kaf
- Semi-tropic 200 kaf
- Etc. (see Fullerton's notes)
- Shasta limited to 50 kaf (flash boards only)...operated by hand
- Delta Islands similar to Game 1 – Discussion re dedication of Shasta capacity increase
- Bacon, Victoria, Woodward Islands...2,000 cfs connector; 4,000 cfs intakes on Islands; all connected in series except for Webb...must be operated by hand
- Webb is a Project island
- 50 kaf at Webb dedicated to EWA
- Can purchase "spot " water OR "option" water ($200/af)
- Demand shifting
- South Delta screens at CCFB (new) 10,000 cfs capacity
- South Delta screens at Tracyl (new) 4,600 cfs capacity
- Projects will have $3,000,000 to use for water quality like the EWA account
- N.B.: Gravelly Ford (project *and* EWA) and Webb (Project) aren't in the Base Study, so must account "by hand"
- Problems getting water in and out of the Kern Water Bank – payback difficult; facilities are still big questions...costs.
- For groundwater, 500 cfs in and out. Use 30 kaf/month.
- Accounts have 20/20/20 kaf available from groundwater

STUDY 834

- See handout notes
- 200 kaf water bank; 500 cfs rate
- Assumed VAMP flows instead of Accord flows
- [Accord plus upstream AFRP runs always need to be a part of the gaming runs to meet comparison needs of water users]
- Study 3 produced the greatest water yield.

D-017142

GAME 2

ASSUMPTIONS

- Same 5 years as last time
- Same biological assumptions
- May do some additional years as time allows
- Question regarding influence of screens on the issue of exports...what will be the changes in assumptions?
- For delt smelt, hydrology and "habitat placement" are the most important issue. Problem with assumptions regarding survival of juvenile and adult salvage. Would like to see less salvage.
- For salmon, there would probably be better survival of the salvage. Prob. Will avoid substantial losses to predation in CCFB.

OCTOBER 1990 – WATER YEAR 1991

- Base = "Study 834"
- Base = 2726 TAF
- Exports = 3,301 Model = 3,600
- Delta = 5,447 Model = 3,740
- X2 = 85.7
- E/I = 0.32
- Chlorides are high...outflow increased to hold back salinity.
- Water users want to purchase water to improve outflow... ($90/ac-ft) 16 TAF = 500 cfs
- Add 500 cfs to both inflow and outflow = $ 3 million
- EWA purchase option for 200 TAF N of delta = $4 million
- OR spend part of Webb Tract water for water quality...(probably not)

N.B. Water quality Account increased to $10 million

NOVEMBER 90

- Exports = 4,497
- Outflow = 3,494
- E/I = 52%
- X2 = 87.8
- Delta smelt population about 4 km upstream of the confluence
- Striped bass getting hit hard at the projects.
- Release water out of Shasta for CHF spawning? NO

- Move 60 TAF out of Bacon inot San Luis (EWA)

DECEMBER 90

- Exports = 5,121
- Outflow = 3,496
- E/I = 0.53
- X2 = 88.4
- Small local delta storm raising outflow but not inflow, therefore E/I controls for 5 days
- Model shows chlorides improving, BUT this is an artifact...salinity did not actually improve.
- Good water in EWA islands could be used as trading stock for Project water either in Shasta or on Webb, especially for spring releases. This points up a distinct disadvantage to whoever has an unconnected island.
- Water users purchase 90 TAF for $128 million
- No fish issues. No movement into delta. E/I not relaxed.

JANUARY 91

- Exports = 3,901
- Outflow = 4,732
- E/I = 44%
- X2 = 86.3
- Outflow is bad (biological assumption)
- Water users release Webb Is. water to improve water quality and pumping to San Luis
- Nothing on fish; only a couple of delta smelt at the projects

FEBRUARY 91

- Exports = 976 Model shows 4,000 Spike in inflow, beginning of the month. Daily model picked up the spike and pumped it. Chlorides dropped precipitously. Seems to be due to a Delta precipitation event. Water might not really be available to pump. Some is due to inflow, which would be available. Probably ought to play the game according to the model, in spite of potential weaknesses. Just remember to take results with caution. Note the potential for error with delta precipitation events (!!).
- Outflow = 11,970
- E/I = 7%
- X2 = 78.5
- Exports reduced to move X2 downstream (starting gate)
- Pumping the delta precip event and the smaller spike in inflow could negatively influence delta smelt, which might use this first storm as a cue to start moving. X2 is barely where it needs to be. Pumping EWA account water might not be such a good idea.

- No salmon issues.
- No push to relax E/I
- Could open the CCG to improve water quality...BUT the model shows a rapid drop to about 15 or 20. In reality, chlorides were pretty high, with the CCG open.
- COULD trade opening the CCG for absence of salmon in the Real Time Monitoring, IF water quality were bad. This would be negotiated.
- If CCG is open initially, adult chinook could be attracted up the Mokelumne and get trapped later when the CCG is closed.
- No decision for this month; this run.

MARCH 91

- Exports = 12,755
- Outflow = 23,902
- E/I = 35%
- X2 = 70.7
- Low densities of salmon appeared in the salvage in March, but the number salvaged is high because of high exports; potentially winter run. CONCERN
- Winter run escapement previous Winter = 441
- Densities of salmon and steelhead around 40-50 per ac-ft.
- Densities of splittail at about 10/ac-ft
- Delta smelt densities in salvage low.
- Potential negotiation: EWA could use Webb for environmental water in trade for something from the Projects. However, there is little in the way of trading stock available from the projects.
- ASSUMPTION: Monitoring on Sacramento river has not detected salmon yet on the first of march, so there was a decision to pump EWA water into San Luis. Seven days later, salmon *were* detected, so EWA pumping ceased. Total pumped was 140 TAF. Relaxed E/I for 5 or 6 days during some inflow spikes. [B.J.: This decision was made in spite of the fact that only a very small fraction of the out-migrants are salvaged. Why wasn't this reaction made for similar delta smelt numbers in the previous month? Answer: There is still a concern with interior delta project-induced indirect mortality. For delta smelt, it was felt that the population effect would be small because of the location of the center of the population, and the inflows are very "spiky".]
- Could have gotten 140 TAF into San Luis in the first week of March, and could use this to reduce exports in the latter half of the month because of salmon in the Sacramento RTM.
- There is a TOC maximum at this time of the year, so putting this water into San Luis could have water quality implications.
- Relax E/I and use fish triggers...needs a percent reduction for the fish triggers. Historical exports were closer to 10 TAF. Set fish triggers to 0.67 (from 15 TAF to 10 TAF) when salmon densities reach 12/ac-ft. Start trigger about 1 week into March.

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- Might have been a steelhead trigger also.
- Water to EWA came our 90 TAF ahead, but this might not be realistic due to model uncertainties.
- Second half of March, implement a steelhead trigger at 5 per ac-ft in order to "fool" the model as a surrogate for relaxing the E/I ratio.

APRIL 91

- Exports = 4,034
- Outflow = 13,978
- E/I = 20%
- X2 = 72.2
- Recall options purchased...exercise options on 30 March: 100 TAF on the SJR, 100 TAF on the Sacramento.
- Can the EWA swap 100 TAF in the Yuba for 100 TAF in Shasta? Might not be able to back up any water into Shasta, since Keswick releases are so low. EWA benefits would still be realized for the delta.
- Water users MAY want to exercise their 90 TAF options too for water quality, except that EWA releases might be enough to satisfy (or partially satisfy) this need.
- Many salmon in the salvage. Fry are gone. Smolts from the SJR are present. Densities are approaching 100/ac-ft on the peaks, with much of this density from SJR smolts.
- Delta smelt are not present in appreciable densities. With this water year type, one might expect delta smelt to show up later.
- Water users choose to exercise 90 TAF in options to be released in the fall for water quality (not released this month).
- Increase SJR for first 2 weeks in April by 2,000 cfs over ambient. Model will mimic this by assuming the flow component of VAMP will be implemented two weeks earlier, on 01 APR. Given historical stream flows, this would mean that the increase would be considerably less than 2,000 cfs over ambient in the beginning of this period, but would be at about this level at the end of the second week in April. This was the actual EWA objective...to "bridge" between the 4,000 cfs flow peak which occurred naturally in the end of March to the normal beginning of the VAMP flows on 15 April. Extra water would NOT be available for export, but would pass through. VAMP restrictions on exports would *not* be imposed during this early period, however. The EWA *could* sell the water and forego "excess" outflow over what could be guaranteed through other means (*e.g.* X2, etc.), but the EWA managers chose not to do so. This purchase would amount to *about* 30 TAF. Model simulated this by adding about 500 cfs for the whole month.
- Nothing on the Sacramento River for fish.

MAY 91

- Exports = 2,160
- Outflow = 7,024
- E/I = 19%

- X2 = 78.0
- EWA *could* grant a variance to the AFRP flows and take some water out...decided not to do anything.

JUNE 91

- Exports = 217
- Inflow = 5,930
- E/I = 2%
- X2 = 81.2
- No fish issues; no actions
- Hold water 'till fall
- From the end of Feb through June, given the changes in water flow patterns, we are speculating greatly concerning the location of the center of population for delta smelt. The situation would *probably* be OK, but *if* the distribution of delta smelt moved to the south delta, the EWA would probably call on some more resources, probably by doing something on the SJR side. Additional options could not be exercised, since they would have to be exercised much earlier. However, some option water is still in storage and might be used, depending on where this water is located. There is some EWA water in San Luis, and this could be sold to generate revenue *or* it could be spilled back to the delta. It could also be held and used for export reduction in the fall. [This situation makes for some hard choices.] Much discussion regarding possible sale and how that would work with respect to price and time of delivery. Risks include what the next year would be in terms of water year type. Water was for sale, but no one wanted to buy.

JULY and REST OF YEAR 91

- Nothing done.
- Water users would release 500 cfs (30 KAF) in *each* of August and September used to increase outflow. No carriage water. This water is for salinity reduction only.

WATER YEAR 1992

OCTOBER 91

- Exports = 3,022
- Outflow = 5,512
- E/I = 31%
- X2 = 85.6
- Outflow high because Contra Costa is governing. The release in September would affect this somewhat. Incidental benefit would be captured by leaving outflow at the 5,500 cfs level.
- Water users release 500 cfs from Shasta for water quality. Released as outflow (no carriage water).

- EWA would release 100 TAF from Yuba and potentially other sources over October and November, 20% of which will go to carriage water. Releases would be coordinated with local water districts to avoid disruptions. A balance of 80 TAF would be pumped to San Luis. On the San Joaquin side 70 TAF would be released and pumped to San Luis with a 10% conveyance loss (balance = 63 TAF).
- Water users will exercise their remaining options for 30 TAF and let it flow out for water quality purposes.
- Achieved water quality objectives?
- Outflow increased by 500 cfs for most of the month.

NOVEMBER 91

- EWA would increase discharge by 1,330 cfs on the Sacramento River and 580 cfs on the SJR, pumping to San Luis after adjusting for appropriate carriage water and conveyance losses (total of 170 TAF). Purpose: to improve spawning habitat on the Merced and Yuba Rivers.
- San Luis status: EWA remainder = 150 TAF.

DECEMBER 91

- Exports = 4,256
- Outflow = 3,496
- E/I = 48%
- X2 = 88.4
- Much EWA water in San Luis.
- No actions.

JANUARY 92

- Exports = 8,487
- Outflow = 4,683
- E/I = 65%
- X2 = 86.4
- E/I controlling?
- [Discussion regarding whether Delta Wetlands is subject to E/I ratios, and whether water could have been put on Webb earlier (1991); potential misunderstanding of the rules.]
- No fish issues; no actions.
- Possible opportunity for EWA pumping with relaxation of E/I. Not done because of X2 starting gate consideration.
- Potential disconnect between the model and historical chloride levels...possible local rainfall artifact.
- Starting gate for X2 requires some pumping curtailment near the end of January.

GAME 2 — BIOLOGICAL ISSUES

ISSUE

- If there is EWA water in a reservoir, and power is generated when the water is released, who gets the power revenues?
- Need to keep track of both increases and decreases in power revenues, and the relative price associated with power generation. Seasonal differences are significant.

GAME

RECAP

- There was a storm in January
- Shouldn't do anything in January for fish or water quality.

FEBRUARY (1992)

- Exports = 10,898
- Outflow = 28,116
- E/I = 29%
- X2 = 72.0
- Spike in Sacramento inflow
- Splittail starting to show up in middle of the month
- Taking some delta smelt
- Starting to take salmon at the SWP, also steelhead later in the month.
- Center of delta smelt is 4-5 km or more (@ km 91.5) upstream of the confluence
- Previous FMWT index approx 630; not particularly good, but better than previous year
- Federal share of San Luis is full; state share will be full at the end of the month.
- End of the month, starting to take winter run, steelhead and delta smelt in troubling numbers.
- Could relax E/I and pump into delta islands
- Shasta not available
- Bromide is low, but TOC is relatively high.
- Decision: play the game hear like 1991; go to outflow limits in the beginning of the month; lower the fish triggers, but relax the E/I for the first week *only* (recalling that triggers will override relaxed E/I pumping) and put EWA water into
- Put delta smelt trigger at 5 per ac-ft; reduce exports to 50%
- Leave salmon trigger at 50/ac-ft

- N.B. With unlimited Joint-Point, and San Luis full, Tracy could be used to augment SWP pumping to fill the state share of San Luis. However, the storm comes in towards the end of the month. In this case, we don't need to do this by hand.
- Water users can put 60 KAF into Webb at the end of the month, within E/I constraints.
- Center of delta smelt population is near Webb, so pumping into Webb cannot happen.
- EWA: Put at least 40 KAF into Gravelly Ford and Kern; put 200 KAF into delta islands.
- See spread sheet for EWA water shifting, etc.; Transfer some EWA water now in San Luis to SWP contractors while filling EWA delta islands.
- Actions taken at end of the month have some striped bass salvage benefits.
- N.B. If San Luis fills, and Webb remains unfilled, this will be a "cost" to water exporters...assuming that biological conditions would have allowed it.
- EWA water pumped into Bacon would not affect delta smelt for this game (in spite of the B.O.), including distribution.
- Decision: EWA will "pay" the Projects 30 KAF. If Webb fills later, the debt would be wiped out.
- Some money might be spent on source control for water quality; TOC relatively high.

MARCH 92

- Exports = 8,227
- Outflow = 15,138
- E/I = 35%
- X2 = 72.0
- Delta is in surplus
- Outflow is controlling
- No Webb diversion possible
- Options were called last fall; 100 KAF in the San Joaquin, 100 KAF in the Sacramento
- March 1, 900 splittail were taken in the South Delta, in spite of low SJR flow. Could expend some purchased water to help move these fish out.
- Could fill Webb instead of pumping in the South Delta, avoiding the need to handle splittail in the salvage. Salmon are also present.
- EWA could pay for foregone pumping in the South Delta and take a credit for water in Webb.
- EWA will add 1,000 cfs to the SJR from an option.
- Assume Webb screens will be effective, so better to shift exports to Webb to avoid salvage handling. Decision: shift the "full amount" (2,000 cfs) to filling Webb.
- Of the 120 KAF on Webb, 30 KAF is to pay back the water users; 90 KAF will be EWA.
- Bacon Is. dropped by 120 KAF due to transfer to SWP for deliveries south of the Delta.

- Reduce exports by 1,000 cfs (60 KAF) beyond the 2,000 of pump shifting (to Webb) for the entire month to optimize biological benefits, especially salmon. Treat as an additional 60 KAF of EWA debt.

APRIL 92

- Exports = 3,020
- Outflow = 10,567
- E/I = 20%
- X2 = 74.8
- Delta is in balanced conditions
- San Luis is at 1,067 TAF; 4 KAF short of full on the State side. Federal share is starting to go down. With significant pumping in the first part of the month, the state side would probably fill; this would wipe out the EWA debt.
- E/I controls for the first half of the month
- Sacramento options would have to be exercised by the end of the month or lost.
- Folsum and Oroville are slightly above minimum pool. Releases are being made for delta outflow.
- EWA Could make releases from Webb and back up some water into Oroville.
- Water users will commit to options (90 KAF; $10 million)
- EWA will commit to options and release for delta outflow: 40 KAF on the SJR and 100 KAF on the Sacramento side.
- Shift 1,000 cfs from Tracy to Bacon due to a spike of salmon at the CVP.
- Most of historical salvage was at the CVP, so these wouldn't show up in this case since the CVP is no longer pumping. In addition, the HORB is in, and many of these chinook probably wouldn't show up.
- SJR release = 40 KAF

MAY 92

- Exports = 1,026
- Outflow = 7,301
- E/I = 9%
- X2 = 78.5
- Oroville release = 4,000 cfs for outflow; could back some water up using Webb water (90 KAF potential)
- Shasta: no opportunity
- X2 is 10 km better than historically, so population ctr is probably at about 86 (just above the confluence)

- Very few delta smelt being taken at *either* project. Should be able to keep delta smelt where they are, so probably would want to keep conditions the same.
- If water were to be backed up into Oroville, Sacramento flow would decrease from about 10,000 - 12,000 cfs to something less.
- EWA water in Webb could be dumped to increase outflow, Q-west and move X2 downstream. Decision: not yet.

JUNE 92

- Exports = 1,080
- Outflow = 6,199
- E/I = 11%
- X2 = 81.0
- Outflow is controlling.
- No water is reservoirs for X-tra release
- Biological problems: Delta smelt salvage shown in model *might* not occur because of earlier actions; the situation would probably be better. Center of population for delta smelt is probably further downstream (X2 is farther downstream). N.B. Model has made the adjustment...but the change is small.
- No actions.
- **N.B. The door was opened to a consideration of changes in water quality for water stored on islands. Webb tract water may become loaded with algae, or change its chemical properties over time. June contains the longest day (in terms of sunlight). [Resuspension wasn't mentioned, but could come up.] Webb Is. could be operated differently in consideration of outflow use versus pumping opportunity.**
- If export capacity would be there, some upstream water could be released (*e.g.* from the Yuba).
- Issue: If only 50% of the years have options availability for EWA, there is an "assurances" problem.

JULY 92

- Exports = 1,080
- Outflow = 4,000
- E/I = 11%
- X2 = 85.2
- Up to 500 cfs of the 10,000 cfs of EWA option water moved per month (Aug., Sep., Oct.) to San Luis
- Could release water from Webb and back up equivalent water into *e.g.* Folsom Reservoir for water quality purposes (reservoir is cooler/deeper; less algae). Actual benefit uncertain; could result in deficit flow situation in the tributary. This might have significant adverse consequences for CHS or other fish resources. Decision: don't do it.

AUGUST/SEPTEMBER 92

- Water quality: 500 cfs purchased water moved ("call" water from EWA) = 60 TAF; $5 million.
- Water supply: Move 30 TAF from Webb to San Luis in JULY
- EWA: Move 90 TAF from Webb to San Luis in AUGUST
- No effect on outflow or X2
- AFRP intent is to protect striped bass e/l in front of pumps.
- This is a classic trade-off of fish against water, since water quality for pumped water from Webb would be worse in August.
- Q-west is positive about 2,000, since the CCG is open.
- There is a biological benefit for the AFRP action...in a negotiation, adjusting water exports to benefit water quality is "just being nice".
- This should be a "decision point" (whether to pump water in July for water quality). Could decide not to pump water in July and leave this as a negotiation item.
- Chlorides are moving up fast from July through August, and Webb water would mix and become degraded more with time. Also, algae, nutrients, pH, etc. increase with time. For water quality, this water should be released as soon as possible.
- Decision: EWA Webb water will be moved in August (all 120 TAF).

WATER YEAR 1993

OCTOBER 92

- Exports = 4,080
- Outflow = 5,463
- E/I = 38%
- X2 = 85.7
- Outflow controlling
- Continue moving Sacramento (Yuba) water
- Continue moving 100 KAF into San Luis
- Purchase options: 100 KAF on the SJR side; 100 KAF on the Sacramento side
- Release 30 KAF for outflow from upstream sources

NOVEMBER 92

- Exports = 4,847
- Outflow = 3,494
- E/I = 51%
- X2 = 87.7

- EWA assets: about 200 KAF in Shasta, 25 extra KAF in Shasta never released.
- No fish issues (striped bass present in significant numbers)
- No water quality issues

DECEMBER 92

- Exports = 11,161
- Outflow = 6,114
- E/I = 65%
- X2 = 84.1
- Could relax E/I (first 2 weeks) yielding 90 KAF to the EWA, but chlorides may be an issue
- See notes from game 1: Storm did not affect SJR, but Sacramento flows did increase. E/I could be relaxed to start with, under the assumption that we could detect salmon moving downstream before they would get into the Delta. When salmon started showing up, other actions (*e.g.* the triggers) could come into play.
- Fish of concern: salmon
- Decision: Relax E/I for first 2 weeks, and pump 90 KAF of EWA water to San Luis.
- Decision: Water quality...cannot pump the first storm to delta Islands, so must let this opportunity go by.

JANUARY 93

- Exports = 14,465
- Outflow = 54,878
- E/I = 23%
- X2 = 66.1
- E/I controlling only for the first few days, then capacity controls
- San Luis is filling rapidly
- TOC is getting high
- Water Qual.: Operators will fill Webb (120 KAF)
- Delta smelt adults and splittail present.
- N.B.: EWA has not used their "banked" groundwater. Operations of this asset not what was anticipated. Could be used as collateral later. If it were project water, it would have been used.
- Decision: Do not fill Bacon; enough water being pumped out of the delta waterways as it is.
- Delta smelt FMWT index previous fall about 157
- Place delta smelt trigger at 10/ac-ft moving to a 50% pumping reduction (cost: 100 KAF out of EWA)

- Winter run sized fish present early in the month. Presence of good screens makes action for winter run less urgent, but still would like protection. Still have "indirect" central delta effects. Water is cold, so predators are probably not very active. Previous winter run escapement was 191 (very low).
- Water users would like to fill Webb.
- Decision: Remove the delta smelt trigger and reduce total exports to 7,500 cfs, spending San Luis water.
- EWA cost: 450 KAF for pumping curtailment.
- Water users will fill Webb instead of San Luis, because Webb will be cut off on 15 February. This means south delta pumping will be at 5,500 cfs. This will last for the first three weeks of the month.
- No EWA water going onto Bacon.

FEBRUARY 93

- Exports = 14,500
- Outflow = 47,502
- E/I = 25%
- X2 = 61.3
- EWA could relax E/I and fill delta islands at 4,000 cfs (2 islands):
- Projects could not fill Webb
- X2 is a bit past Roe Island
- Fish issues: Salvage pulse of chinook at the SWP which are winter-run size. Many fish salvaged, but at low density (approaching 5-10/ac-ft) at the end of the month (last week).
- Set a steelhead trigger at 10/ac-ft, cut export rate by 50%. Two weeks of curtailment; EWA cost is 240 KAF. *N.B. Actual target for protection in winter run chinook.*
- Issue: Dan Nelson would like to take water sales on the spot marked off the table. We will play the game assuming a spot market which can be used.
- Buy 100 KAF on the spot marked ($20 million) to be delivered later.

MARACH 93

- Exports = 11,128
- Outflow = 32,097
- E/I = 26%
- X2 = 62.8
- Strong outflow recession between storms in beginning of the month. Large flow event in second half of the month. Strong recession shows a large (downward) divergence from the historic base, probably due to greater upstream retention in the modeled run.
- Big discrepancy in San Luis storage, and building. (San Luis is more empty than historically)
- Big EWA debt in San Luis.

- EWA could relax E/I and pay off some of this debt, but only for a few days.
- Decision: Relax E/I for the last two weeks. Tradeoff is uncertainty over fish presence. Could be some winter run left in the area. Payback amounts to 111 TAF.
- Can't pump onto the islands because of the delta smelt BO

APRIL 93

- Exports = 8,154
- Outflow = 38,203
- E/I = 17%
- X2 = 61.9
- Roe got triggered again
- Could cap exports at a "certain level" and pull water into delta island screens as a pass-through thus getting SJR fish further downstream (down Old River) before they encounter screens. HORB is closed. An alternative rationale is to pass fish into the improved CCFB screens and transport fish out of the delta artificially, thus getting around the south delta dead-end with flow and potential losses to predator accumulation. There are risks with both rationales.
- Cut exports to 10,000 for one week (second week) Cost = 70 KAF
- Buy options
- VAMP takes over after the 15th

MAY 93

- Exports = 5,005
- Outflow = 29,983
- E/I = 14%
- X2 = 63.5
- San Luis is critically low
- EWA: Pump 60 KAF out of groundwater to make up part of San Luis deficit.
- EWA: Deliver 25 KAF from previously purchased options (continue for 4 months).
- Shasta is nearly full
- No actions

JUNE 93

- Exports = 12,441
- Outflow = 19,169
- E/I = 35%
- X2 = 67.4

- X-tra pumping just met demand out of San Luis
- Splittail showing up at the pumps, along with delta smelt. HOWEVER, VAMP would have changed the densities of these fish (centers of distribution) (assumption).
- EWA: Pick up an extra 40 KAF from relaxed E/I to pay back part of San Luis

JULY 93

- Exports = 5,487
- Outflow = 8,000
- E/I = 30%
- X2 = 75.4
- Option water available: 100 KAF on the SJR side; 100 KAF on the Sacramento side.
- Chlorides are starting to rise, but still quite low.
- Stop pumping out of Semi-Tropic
- Contractors: Deliver 90 KAF from Webb to San Luis
- With chlorides this low, carriage water requirements are much less (between 0 and 10%)
- EWA: Move 100 KAF out of the Sacramento basin (water purchases)
- Call all of Sacramento options (= 100 KAF less carriage water)
- Call all avail water out of the SJR side (= 100 KAF less 10%)
- Make one 25 KAF spot purchase on SJR side (San Luis Basin)

AUGUST/SEPTEMBER 93

- Exports = 13,498 / 10,332
- Outflow = 4,000 / 3,377
- E/I = 65% / 65%
- X2 = 83.3 / 87.2
- Outflow limiting
- NO ACTIONS

X-TRA NOTES:

- Fewer actions this time. Possibly because of learning curve.
- Needs to be more "blind" or "randomized".
- This is starting to be familiar biological information...need to get into different scenarios.
- Given new facilities (*e.g.* CCFB screens) we should figure out what to do differently.

- Whoever has a pipe from their island has an advantage.
- This represents a very good flexibility tool.
- Need to get to the water supply bottom line.
- Need to get creative for other-than-flow measures which will benefit the environment; add more environmental tools which can be an offset.
- Water quality issues have made this a more complicated exercise...time taken for water quality decisions will probably shrink.
- Water south of the delta was for sale, but remained too expensive for the exporters to take advantage. Other sale options for water users are part of the market. Perhaps new pricing guidelines are needed, if these are not realistic.
- Pricing needs to be more realistic. "It's a market."
- Shouldn't set pricing guidelines so that sales are forced or prohibited..."It's a market."
- Water supply, quality, fish, etc. is pretty well coordinated as far as we are going, but there are many variables which are not included. The rest of the CalFed program needs to be considered.
- To optimize the system, firm criteria (ops) need to be more flexible.
- Need to display the consequences of new actions v. historical biological situation.

GO BACK TO CONTINUE GAME 2 – WATER YEAR 1994

October (1993)

- Exports = 12,989
- Outflow = 5,570
- (E/I = 65%)
- X2 = 84.7
- EWA Assets: 120 KAF in groundwater; 155 KAF in San Luis; options available; room in Shasta
- Water Supply assets: Webb not full; San Luis (uncertain). Export chlorides are at 250 mg/l in the beginning of the month. Exporters are releasing 30 KAF from Yuba to improve water quality.
- EWA *could* relax E/I to increase assets, but this would "steal" the water quality water being released from Yuba.
- Fish actions: EWA *could* relax E/I for a few days at the end of the month when chloride standards are met and pump to increase assets, resulting in a slight decrease in the water quality release benefit. Decision: E/I relaxed and 45 KAF are pumped to EWA assets. EWA *could* put 60 KAF into groundwater, reducing some of the risk of losing it. *Could* put this water into Bacon, also. Decision: Move 75 out of San Luis to Bacon; move 40 out of San Luis to groundwater; get an additional 45 out of the delta due to relaxed E/I.

November 93

- Export = 10,055

- Outflow = 4,502
- E/I = 65%
- X2 = 85.5
- Fish actions: *Could* move the rest of EWA assets from San Luis to Bacon. Decision: Close DCC.
- Water Supply actions: No actions.
- Water Quality actions: No actions.

December 93

- Exports = 12,622
- Outflow = 5,854
- E/I = 65%
- X2 = 83.7
- Fish actions: Salmon present after the first week; cut exports to 5 kcfs for the last three weeks (little or no asset cost, since much of the high pumping is already past). Asset cost = 120 KAF from a debt. EWA goes into debt in San Luis. Shift 40 of EWA from San Luis to groundwater (20:20). See chart for total debt. N.B. San Luis is almost full, so debt will probably be wiped out very soon.
- Export chlorides are very low; X2 is about 80.
- Interruptible were in George's model. Because of the EWA cuts, the interruptible deliveries are not made.

January 94

- Exports = 9,229
- Outflows = 9,984
- E/I = 49%
- X2 = 79.1
- EWA debt in San Luis will be wiped out in first week. Delta smelt not a problem; previous year's FMWT index is OK.
- Fish actions: Keep exports at 5 kcfs for first week; hold exoprts at 7,500 for weeks 2, 3, 4. Discussion of where to focus increase in assets...whether to put EWA assets into Bacon or somewhere else, depending on the center of distribution of delta smelt. Too early to pump directly to Bacon (B.O.). Decision: move EWA water onto Bacon through Clifton Court at a rate of 2,000 cfs = 80 KAF. Put 40 KAF into groundwater through CCFB and San Luis. Bacon complex is now full.
- Water Quality: No actions

February 94

- Exports = 6,166
- Outflows = 25,902

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- E/I = 20%
- X2 = 70.2
- EWA Actions:
- Fish status: Lots of hatchery salmon; mostly Merced yearlings...historically...probably won't be continued in Stage I. Delta smelt are OK. No fish actions.
- EWA: Move 40 KAF into groundwater through CCFB and San Luis.
- Water Supply: 2,000 cfs onto Webb; 120 KAF total.

March 94

- Exports = 5,180
- Outflow = 10,829
- E/I = 30%
- X2 = 74
- Fish status: Salmon present; winter run present in significant numbers; plus late falls. Delta smelt OK. A few splittail at the projects but at low levels.
- Fish Actions: Hold pumping to 4 kcfs in the south delta to protect winter run. Supply water to the Projects from Bacon Is. San Luis is still full. Extra allowable pumping (about 1,000 cfs due to higher than usual flows in the SJR (1/3 of flow can be pumped); decision: cancel the extra allowable pumping to optimize winter run protection. EWA Cost = 17 KAF; take out of Bacon

April 94

- Exports = 2,873
- Outflow = 8,551
- E/I = 22%
- X2 = 77.1
- Fish status: Some winter run still present (stragglers); some SJR CHF showing up (smolts). Delta smelt are starting to show up, especially at the end of the month. Inflow at Vernalis is about 2 kcfs.
- Fish actions: Supplement SJR flows in the pre-VAMP period from 2 kcfs to 4 kcfs (60 KAF). Cut exports to 3 kcfs for the same time period (2 weeks). Water *could* be backed up into Oroville in the beginning of the month and dedicated to outflow at the end of the month when delta smelt are present. Decision: Water goes to outflow for the whole month. Bridge to VAMP and protection of winter run. Delta smelt get protected in the end of the month. EWA cost = 60 KAF out of Bacon.
- EWA purchases and exercises options; use 60 of these for SJR augmentation.
- Water quality: No actions.
- Water supply: No actions.

May 94

- Exports = 2,114

- Outflow = 8,032
- E/I = 17%
- X2 = 78.5
- Fish status: VAMP in effect. Fall run fry in the salvage. Fish are pretty much OK. Exports have been reduced by a great deal from historical levels. X2 at about 75. Historically, take limits controlled exports, even when they were at relatively low levels.
- Fish actions: Let VAMP run; no additional actions.
- EWA actions: No actions.
- Water supply: This is now a critical year.
- Water quality: No actions.

June 94

- Exports = 5,903
- Outflow = 6,199
- E/I = 35%
- X2 = 81
- Fish status: X2 is at Collinsville; salmon are finished showing up; delta smelt still present at the projects in significant numbers. HORB is open in early June.
- Fish actions: *Could* put more water down the SJR in the first 2 weeks of June with the HORB open, to benefit delta smelt (letting the natural flow split go down the Old River channel). Decision: do it (40 KAF of options). *Could* back this water up into Shasta after it does its good in the delta, but the model says this can't be done (Shasta operations and status). Let the water go to outflow. Hold exports to 2,500 cfs in the first 2 weeks; hold exports to 3,500 cfs in the second 2 weeks. Take assets first out of San Luis, then out of Bacon. EWA cost = 60 KAF. Discussion of doing even more to protect delta smelt, but there may be a need for assets to be accumulated in case things get (or stay) bad in the future. Assets are pretty good, however. Decision: spend some more assets to protect delta smelt: Further constrain project pumping to 1,500 for the first week and 2,500 cfs in the second week, 3,500 cfs in the third week and 4,500 cfs in the fourth week; take 60 KAF assets out of Bacon = 120 KAF. *Could* move some assets out of Shasta and refill some of San Luis. Decision: do it later.
- EWA actions: No actions
- Water supply actions: To the extent that the E/I action was assisted, the Projects should be able to move Webb water...but can't do this until July. Also this would have canceled the benefit of the SJR releasesWater quality actions: No actions

July 94

- Exports = 5,903
- Outflow = 4,000
- E/I = 40%

- X2 = 85.2
- Fish status: Salmon OK. Delta smelt still present; splittail OK
- Fish Actions: *Could* capture a small inflow peak; but the rules say that the allowable July = the allowable June. Lots of striped bass juveniles present; forego capturing the small amount of water that could have been pumped to EWA to protect striped bass. Delta smelt *could* be further protected by releasing water to the Projects out of Bacon; 19 KAF remaining.
- Water supply:
- Water quality: Could export water from Webb at relatively low chloride levels in anticipation of higher chlorides in August for water quality purposes. Would have to relax AFRP (Delta Action 7). Better in early July. Decision: Relax Delta Action 7 constraint for the second half of the month only; allow pumping of Webb water for 2 weeks (60 KAF). Means some EWA credit; amount is now uncertain. If delta smelt are west of Webb, this would benefit the species. This is accounted as a "negotiation debt" (good will); pound of flesh later.

August 94

- Exports = 11,894
- Outflow = 2,992
- E/I = 65%
- X2 = 88.7
- Fish status: Lots of striped bass (but coming down from a very high peak); very little else.
- Note: Back-calculated birthdays of delta smelt which survived were in the VAMP period. (Coincidence?)
- Water Quality action: Dump 30 KAF from Yuba to outflow for chloride reduction.
- Water supply:
- EWA: *Could* move some purchased Yuba water from north of delta to San Luis. Cannot back much water into Shasta and trade Yuba because of Shasta status. Might be able to back up 20 KAF; if E/I is relaxed, EWA could export much water. Decision: Back 20 KAF into Shasta by increasing Yuba flows by 50 KAF; put the remaining 30 KAF into San Luis less carriage water (net = 24 KAF).

September 94

- Exports = 6,280
- Outflow = 3,000
- E/I = 55%
- X2 = 89.9
- Fish status: No problems. No actions.
- Water Quality: move 30 KAF to outflow from Yuba.
- Water supply actions: move all Webb water 1,000 cfs for the month = 60 KAF.

- EWA actions: *could* move 50 KAF from the Sacramento options to San Luis less carriage water = 40 KAF to San Luis. N.B. Might result in encouraging salmon spawning and stranding redds when the transfer is complete. Better to spread it out over at least three months. Decision: Move 250 cfs out of the Yuba for the month (and continue for two more months...and hope for rain). Move 20 KAF from Shasta to San Luis.

GENERAL COMMENTS ('ROUND THE ROOM)

- Much was done for smelt in June and July of the last year (1994) done in Game 2
- In the Crediting game, assets were expended very quickly and nothing could be done after that.
- The crediting game helped identify some questions with which we all must come to grips.
- Refining how credits are assigned is a need.
- Rhoads doesn't like crediting approach.
- The extension of Game 2 was helpful to fish
- Water quality is being considered more and more constructively.
- Frustration with discrepancies between the DWRSIM and the daily model.
- Crediting is frustrating because there aren't enough credits at the beginning to do much for fish. Something else is needed.
- 1994 was an easy year; 1995 will be harder.
- Crediting is difficult; demand shifting has a very large impact on fish protection. The demand quantities needs to be quantified more precisely with a rationale.
- Gallon for gallon seems better now, but the crediting approach needs to be given a fair chance with some refinements.
- EWA needs to be modeled better; the model needs up-grading.
- Better synergies are developing between EWA and the Projects.
- In some cases, the EWA can help develop water for the projects, and/or solve water supply/quality problems
- Some baseline differences were observed when solving problems; the facilities and "automatic" parts of the model/system and this helps.
- These exercises should help folks understand flexibilities and alternative approaches to solving problems. Need to understand what is flexible and what is fixed...on both sides (fish and water supply/quality).
- Build target demands first, but recognize flexibilities and tradeoffs.
- Starting to take advantage of synergies between EWA and Projects...taking a more cooperative approach. Some tradeoffs are inevitable and need to be recognized, but opportunities exist and are important.

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- The "real" game should model the upstream reservoirs more. Some advantage might be taken of the AFRP flows. Need to operate with sensitivity to these AFRP flows.
- Demands are a weak point in the forecasting and in the models. How demand forecasts affect allocations presents problems, across various year types.
- Crediting approach might have some promise if changes in accounting basis.
- Transfers and capabilities are a function of flexibility. This is getting more and more sophisticated and complicated.
- Cooperative ownership of facilities could help the crediting approach. Would need cooperative operation.
- The "real game" needs some realistic assessment of how it would work. Some skepticism that it could be done correctly. Salvage patterns superimposed on a different year's hydrology would be difficult. Might be very difficult to measure success (no comparative base). This needs much careful thought. On the other hand, when we get to the "real world", there will not be a comparative base either!

GAME 2 – BIOLOGICAL - WATER YEAR 1995

October (1994)

- Exports = 5,100
- Outflow = 4,000
- E/I = 48%
- X2 = 90.4
- Fish issues: MWT for delta smelt previous fall is low; delta smelt population center of delta smelt is near Decker Is.; winter run escapement previous year is 200; spring run escapement previous year = 1,500.
- EWA options: 380 KAF caryover. Options are such a bargain, that EWA might as well buy them. Decision: buy 100 KAF on the Sacramento side, 100 KAF on the SJR side.
- San Luis capacity is limiting.
- EWA action: Move 17 KAF kform Yuba to San Luis (285 cfs) (net = about 15 KAF) (continuation of a decision made in previous months). Rationale, transfer of assets to San Luis is a good strategic move; carriage water will contribute to instream flows and outflow, with associated environmental benefits.
- Water Quality: Release the last 30 KAF from previous year's options (500 cfs) from the Yuba. N.B., this will add to the 285 cfs release by the EWA account. This creates a concern that when these releases are terminated, salmon may have spawned during higher flows and some redds may be stranded. This is only a relatively small proportion of the total flow, but care should be taken when making these transfers and water quality releases. There is a potential to move EWA water earlier in the year (summer) and park it in Webb tract, but this would be contrary to current Delta Wetlands operations rules. Possible to make a special relaxation?

November 94

- Exports = 6,000
- Outflow = 6,000
- E/I = 51%
- X2 = 85
- Delta smelt index is low; no salmon being salvaged; striped bass present.
- Possible to relax the E/I and pick up about 100 KAF for the EWA from a relatively large inflow spike lasting about 4 days and another smaller spike at the end of the month. Decision: do it.
- Water quality: The relaxation of the E/I and taking water into the EWA resulted in an increase in export chlorides. Some discussion about how the EWA might be "sensitive" to water quality needs. No rule governing how the EWA should respond to water quality impairment. Could limit EWA exports to 10 kcfs to protect water quality. The decision was made to do this based on a "negotiation". Would be better to have rules in place to facilitate such negotiations, possibly with the exchange of money. This means a net of about 65 KAF instead of the 100 KAF that would have resulted without restraint on the part of the EWA. The resulting chloride levels in exported water stayed significantly lower than they would have. "The negotiation was a success."

December 94

- Exports = 7,500
- Outflow = 9800
- E/I = 42% (with big swings !!!)
- X2 = 84, historically...could be a bit farther downstream due to water quality actions (not much).
- Fish status: spring run (but no winter run) salmon begin showing up in the salvage at the end of the month. Delta smelt index remaining quite low.
- EWA could relax E/I and obtain some more water. However, this is the first real inflow pulse of the year, and there should be some concern over winter run smolts showing up in the delta. Water quality would probably not suffer, since X2 is beginning to move rapidly downstream as a result of the inflow pulse. Decision: Relax E/I and have EWA pump up to 10 kcfs in the first week, model limits in the second week, max exports in the third and fourth week of 7 kcfs to protect spring run salmon. No E/I relaxation needed for the second two weeks. Net cost to EWA was 110 KAF.
- Water quality actions: None
- Water supply actions: None

January 95

- Exports = 11,651
- Outflow = 105,592
- E/I = 20%
- X2 = 55
- Fish status: Adult smelt in relatively low numbers at the pumps; lots of striped bass; some winter run, some spring run and some late fall run juveniles in the salvage. Delta smelt index is very low

(can't use the Delta Wetlands islands until later). Splittail are also present in increasing numbers in the salvage.

- Water supply: Put 2 kcfs onto Webb in the last two weeks (60 KAF). Shasta is spilling, so EWA gets 50 KAF in Shasta. San Luis might fill in February.
- EWA actions: Salmon are present throughout the month, so there is a concern. The level of salvage may mean somewhat less than otherwise with this very high level of inflow/outflow. Decision: limit exports to 10 kcfs for the entire month. Cost to EWA = 225 KAF. Doesn't make much sense to limit south delta exports and allow the filling of Webb. Discussion of what kind of water balancing of exports (San Luis v. Webb) and what constitutes the best protection of migrating juvenile salmon (especially from the Sacramento side. There will be an interruption in the "stream" of migrating salmon moving into the delta (could be picked up in monitoring). Decision (revision): Limit the *sum* of exports out of the south delta and onto Webb to 10 kcfs for the protection of *both* delta smelt and chinook.
- Water supply decision: Given the EWA constraint, the choice is to put 10 kcfs into San Luis in the first 2 weeks (Webb is not available in the first 2 weeks) and 2 kcfs on to Webb for the second two weeks and 8 kcfs into San Luis for that same time period.

February 95

- Exports = 6,500
- Outflow = 129,400
- E/I = 6%
- X2 = (Port Chicago EC = 0.08) WAY downstream
- Fish status: Delta smelt peak beginning to wane; likewise salmon peak is beginning to wane.
- EWA could fill Bacon since fish peaks are falling. Decision: do it.
- Water supply actions: Pump to new 15 kcfs capacity into San Luis. Assume higher pumping rates will *not* increase fish densities by changing migration patterns.

March 95

- Exports = 2,800
- Outflow = 178,000
- E/I = 4%
- X2 = WAY downstream
- Fish status: Historic pumping was so low, the salvage information is not reliable.
- N.B. Part of the problem in wet years is that this game doesn't deal with demand very realistically. The model also doesn't deal with unscheduled surplus deliveries. These issues may affect strategies for both moving water and for restrictions/EWA account actions.
- Fish actions: *N.B. The fact that historical pumping was so low, and there is no reliable fish density information, makes these decisions and rationales tenuous.* Few adult delta smelt present, but moving upstream. No actions (see caveats).

April 95

- Exports =
- Outflow =
- E/I =
- X2 =
- EWA account: Move 20 KAF to Semi-Tropic.
- EWA move 60 KAF from Bacon into San Luis during VAMP.
- Water supply actions: Pump to meet demand.
- Water Quality: Chlorides are at "detection limits" (very low); no action.
- EWA could back water into Bacon Is. through CCFB. Still great uncertainty about the density data. Would involve 2 kcfs for 2 weeks (until VAMP). There is a reluctance to be in the "stockpiling mode" when the EWA resources are so flush. Decision: Do *not* pump from CCFB into Bacon.

May + June 95

- Exports = 4,200
- Outflow = 100,000
- E/I = 4%
- X2 = *WAY* downstream
- EWA: Move 20 KAF to Semi-Tropic (both months) from San Luis; move 60 KAF from Bacon into San Luis in May during VAMP. EWA let options expire without exercising any of them.
- Fish status: Very high splittail densities in the salvage. High densities of chinook in the salvage; some steelhead showing up. Striped bass densities *relatively* lower. *Could* limit exports in the first two weeks to protect salmon. Would bring salvage down to historical levels, with additional benefits due to improved screening/handling facilities. Could limit exports to 7.5 kcfs for the first two weeks of June to protect both splittail and chinook, or could ramp from some lower level in the beginning of June to some higher level later on in the month. Decision: Limit exports to 3 kcfs in the first week; limit exports to 4.5 kcfs for the second week; limit exports to 6 kcfs for the third week (densities still high, especially for splittail); fourth week, no restricitons (Projects pump at new capacity of 15 kcfs). Cost to EWA = 450 KAF (EWA did not have access to the first 15 kcfs ot the 21 kcfs of total capacity).
- For the San Luis debt, the EWA can cary over *if* there is no harm to the Projects relative to deliveries.

July, August, September 95

- Exports = *N/A*
- Outflow = *N/A*
- E/I = *N/A*
- X2 = *VERY* far downstream (still)

- Fish status: Still very high splittail and consistently high striped bass densities. No particular salmon or steelhead worries.
- EWA: Still owes some water in San Luis. Put 200 KAF onto Bacon in July.

END OF THIS WATER YEAR

GENERAL DISCUSSION OF RESULTS TO DATE

Agenda

- How to make the transfer rules more realistic
- Test some features of the EWA this year (in real life)
- Future games (parameters; rules; etc.)
- The number of years in the sequences we have been modeling is likely too small.
- Meeting quality and supply needs...policy. Phase II
- New allocation of resources (negotiating points; the "real" game)
- Benefits analysis (evaluation of the games)

EVALUATION OF BENEFITS: FISH; WATER QUALITY; WATER SUPPLY

- Need to compare to Prescriptive Standards
- Use graphics (how to?)
- Timing relative to Cal Fed schedule
- Karl, Mike, Bruce and Jim White will work on fish benefits and have a product ready on Monday
- Compare to baseline, historical and Prescriptive Standards
- Need to identify monitoring needs of EWA for feedback to CMARP
- Spreadsheet scorecards are available (like the packet for Game 1). Game outputs will be similar to the Game 1 outputs. Need to add changes in Shasta Storage, changes in Sacramento River flow, perhaps others.
- When comparing to historic v base changes need to look at relative differences.
- Predominately one or two months in the year contain the most changes. Look at tradeoffs among months, not just the end-of-year bottom line.
- Figure out how to identify actions/benefits that don't show up in "net" numbers.
- Comparisons between EWA and Prescriptive Standards could give insights into how the EWA might be operated.
- "The accord was the cake; this is the icing"; this is generally understood. Need to show this clearly.
- The score card from the modeling will give the bottom line on entrainment.

- Upstream benefits (*e.g.* stream flow; temperature) and perhaps some of central delta conditions don't show up on the score card, *although* there is a salmon "savings" which is imputed in the scorecard through an equation.
- Benefits associated with running water through delta islands (esp. Game 1) aren't on the scorecard.
- Using a different DWRSIM run as a base will result in a different set of inflow parameters.
- Need to show the relative benefits of EWA and VAMP and associated EWA costs.
- Prescriptive Standards: Eight R. Index less than 1 million AcFt, Q-West should be 1,000....**Get this from Mike.**
- Look at salmon issues before running Prescriptive Standards through Russ' model.

Water Quality

- Notion of "continuous improvement" does not mean every day is improved; rather it means that on balance the water quality gets better.
- Every urban supplier has a different need, depending on blending requirements.
- CalFed needs to come up with regional solutions which address a variety of details...needs to address regional exchanges.
- Watershed "loading", not concentrations of constituents, will demand a large amount of focus.
- Source control is very important.
- Many very large, even conceptual, "details" to be worked out.
- When games result in increased outflow, this generally helps water quality.
- Prescriptive Standards may help chlorides (depending on how they are patterned).
- Need to compare fish benefits and water quality benefits...when they converge; when they diverge (if ever).
- Organic carbon: different approaches; could use a weighting approach. Hydrodynamics modeling would be a better approach (more reliable results), but is costly and time-consuming.
- Could use "MWQI" as a starting point; weight concentration and multiply by export pumping to get a first-order approximation.

Water Supply

- Schuster would like to get together with various representatives of the water users to identify supply targets relative to SJR flows, groundwater stocks, cost curves, depletions, etc.
- Need to define what is desired.
- Mix of guaranteed deliveries by water year type or other approaches.
- Need to reconcile George's model with the work of this group...talk to George.
- Need to define how much this tool helps in generating and understanding gains (or losses) in water supply

RELATIVE VALUES OF THE TWO ACCOUNTING SYSTEMS

- Ask Spreck to write up the comparison of results; why we abandoned the "Credit Approach" after two years.

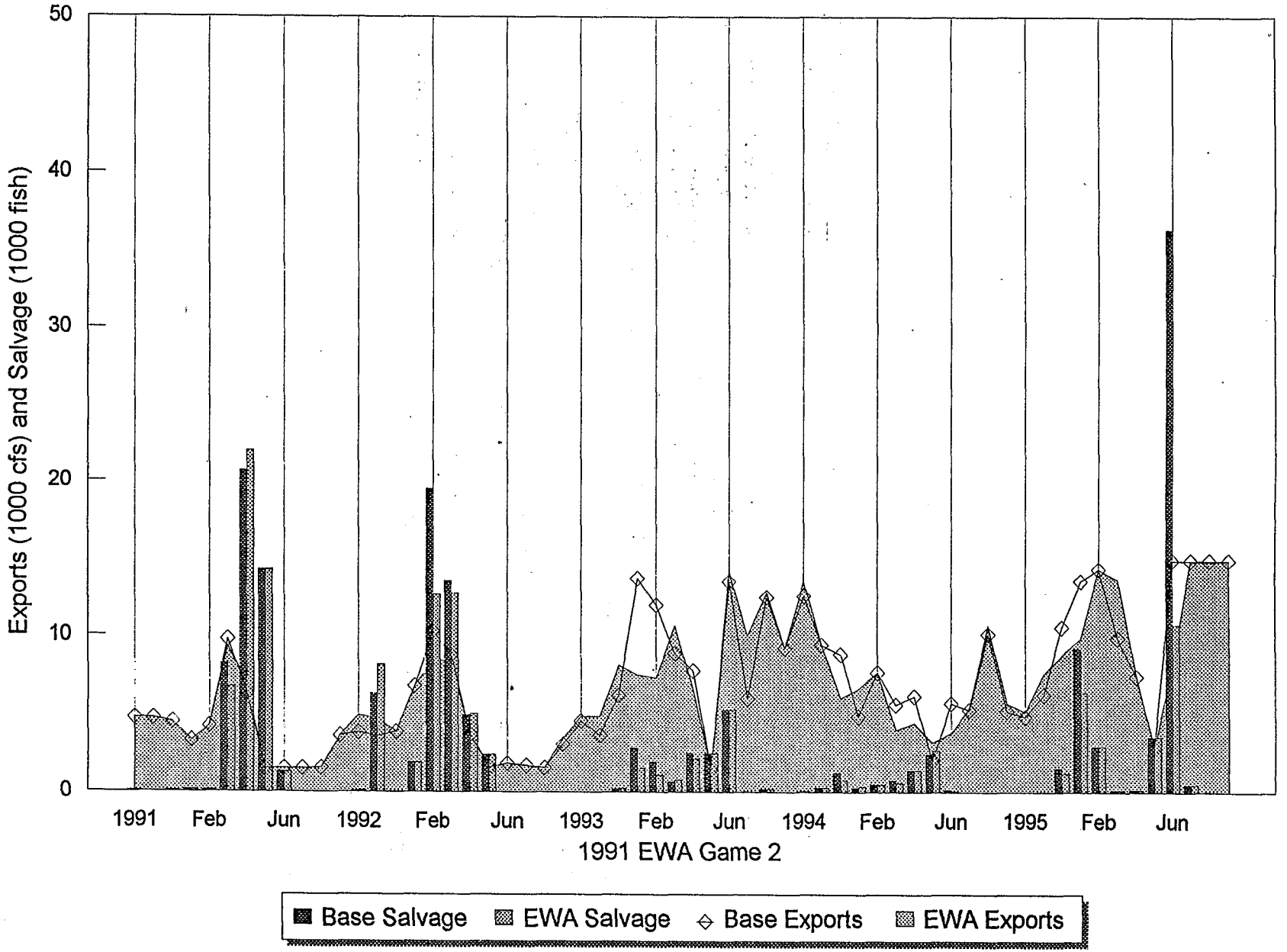
THURSDAY GAME (Game 4) (See handout)

- New "assets" include 8,500 cfs capacity...when to add?
- Policy guidance is that 8,500 cfs capacity would track ecosystem restoration implementation. Could this be just an "assurances" issue? Assume that the assurances issues are solved, and that these features are in place at the start of Phase I.
- Is it appropriate to adjust the sharing formula for the 10,300 cfs capacity?
- COE needs to give approvals for extra pumping capacities (channel integrity)
- E/I variances
- In-delta AFRP variances
- Kern water bank and Semi-Tropic...assume both are empty at the start.
- Need to resolve potential conflicts with other groundwater bank users, especially for the Kern bank.
- Shasta Dam: Increase in capacity (freeboard). Currently, there are some flashboards that go on top of the radial gates (18" or 36"??). Could go up to an additional 6 ft with not much trouble. (Environmental documentation shouldn't be much of a problem). EWA shares this.
- Transfers: Attempt to make this more realistic, even if it is more complex
- Demand shifting: Haven't used it yet, but can use in this game.
- May wish to share the increases in south delta capacity. Formula to be decided. Several ways to go. Could be capacity over a certain base; could be a certain constant percent; [could be a sliding scale]. There are some physical constraints, including tidal constraints; seasonal constraints related to debris loading; channel capacities; etc.
- New fish screens, etc. are *not* assumed.
- In-delta AFRP will be included in this game. (EWA will accommodate in-delta AFRP in Game 5).
- "Heartburn" over using the "big pumps" for "environmental protection" (EWA) in dry and critical years. There at least should be some caryover to subsequent years...or later that year. This would be real "conjunctive use" caryover. This would mean a sharing of caryover storage, perhaps in various places. Could apply a seasonal formula for allocating EWA share or "ownership" of the extra pumping capacity. Perhaps share when the delta is in surplus conditions, but not when the delta is in balance. The sharing would be when pumping is above 6,680 cfs. There is a question how this would be different from a prescriptive standard, imposed on a monthly basis, unless the EWA anticipates that in some months it would actually use some of its pumping capacity and place some water in (say) San Luis. Need to resolve these issues with respect to a matrix that came out of the Small Group. There is a clause in the Small Group, "...except as modified by the EWA". This allows the EWA to re-shape the work product of the Small Group.
- Could marry the capacity increase sharing with a sharing in exports realized with a relaxation of E/I...that is, when E/I is relaxed for the EWA, some percentage (say, 1/3) of the exported water goes to water supply.

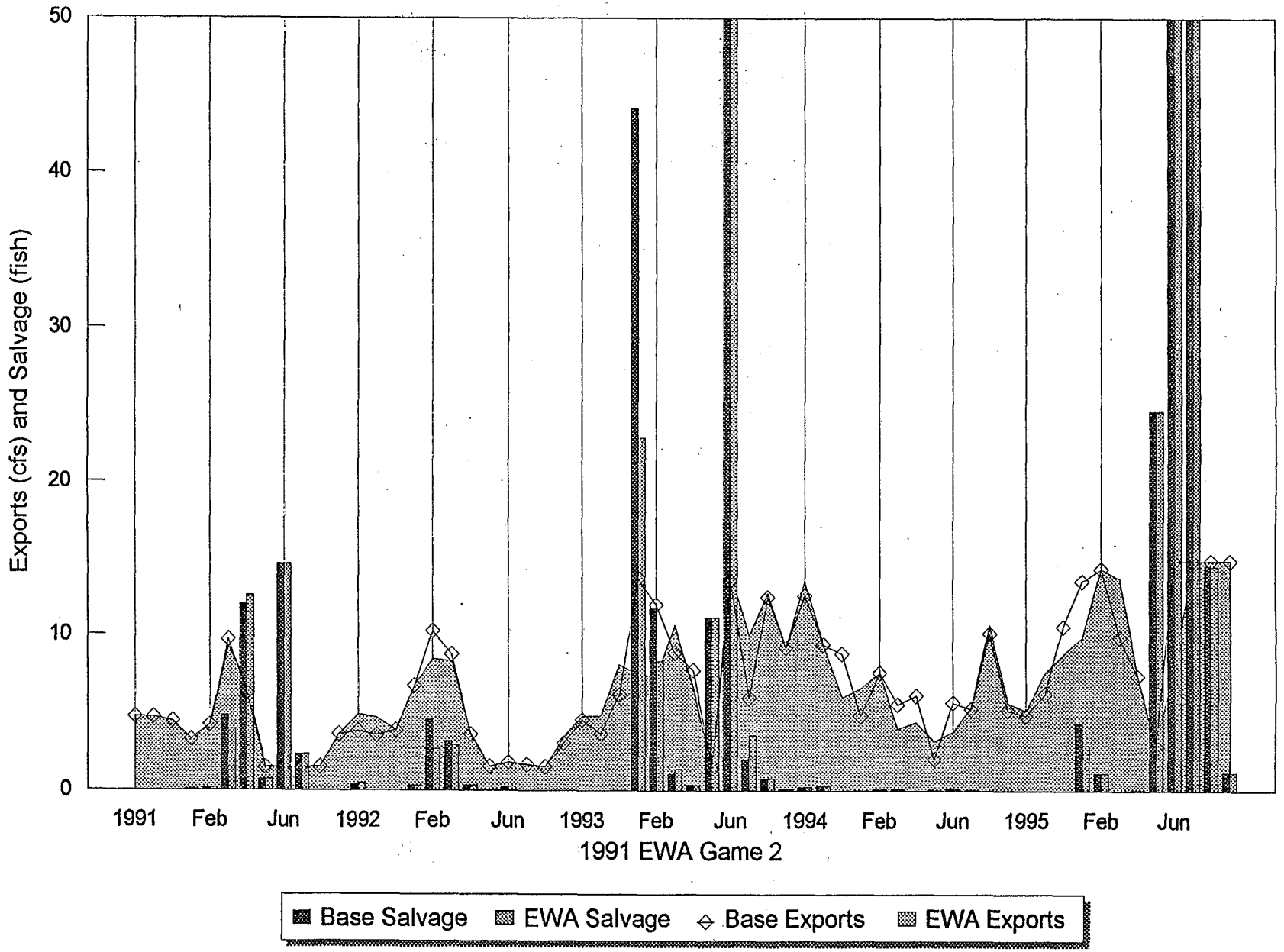
- Some question as to whether 8,500 could ever be realized in Stage I. Also, some question as to whether increased Shasta could be realized without a full-blown EIS.
- May not be worth playing Game 4 at all, if the increases in capacity can't be realized.
- Trade In-Delta AFRP for Interim South Delta Project??? (to make it a game).
- Water transfer options for EWA gaming...see handout.
- Water transfer options include risk factors and delay periods; price elasticity; quantities available; differences among water year types; etc.
- In reality, the EWA probably cannot use the option market all the time, like we have been doing. There will also be some competition. If the option "falls through", the fall-back would be to (*e.g.*) the spot market with a quantity limit.
- Stein Buer: The 8,500 cfs pumping capacity is still a goal, but may not be a realistic one...probably isn't. Need to go to a supplemental EIS/EIR. Corps would need to issue a Sec. 10 with a public interest review; EIS Section 7 consultation. Sub-team deliberations: this will be a contested action. So. Delta Water Agency will intervene, and is "concerned" about all seasons, not just the summer. Benefits: Good relationship between the pumping drawdown and flow in the SJR. Using this and looking at 10,300 cfs...OK if SJR is above 1,000 then the Projects can pump 1/3 of it, at least under historic conditions. With an additional time period (Dec 15 through March 15), there is some additional benefit. For 10,300 the benefit is 100 KAF in an average year and 2 KAF in a critical period. Assume the 8,500 is available from Nov thru Apr when SJR Q is > 1,000 cfs (pump 1/3) and assume temporary barriers is continued. From 01 June to 01 Oct, assume some interim level of pumping capability (between 6,680 and 8,500)...this is pushing the envelope.
- JPOD is in? Appropriate to keep it in? Not working with much else in EWA assets. May need more money or other assets (which?).
- Reviewed other assets for the game (see handout).
- Don't need a water quality account this time (the usefulness has already been documented).
- Collateral should be discounted according to risk factors in water options summary (see handout)

Another source of project yield could be EWA San Luis storage to meet low point. Also, projects

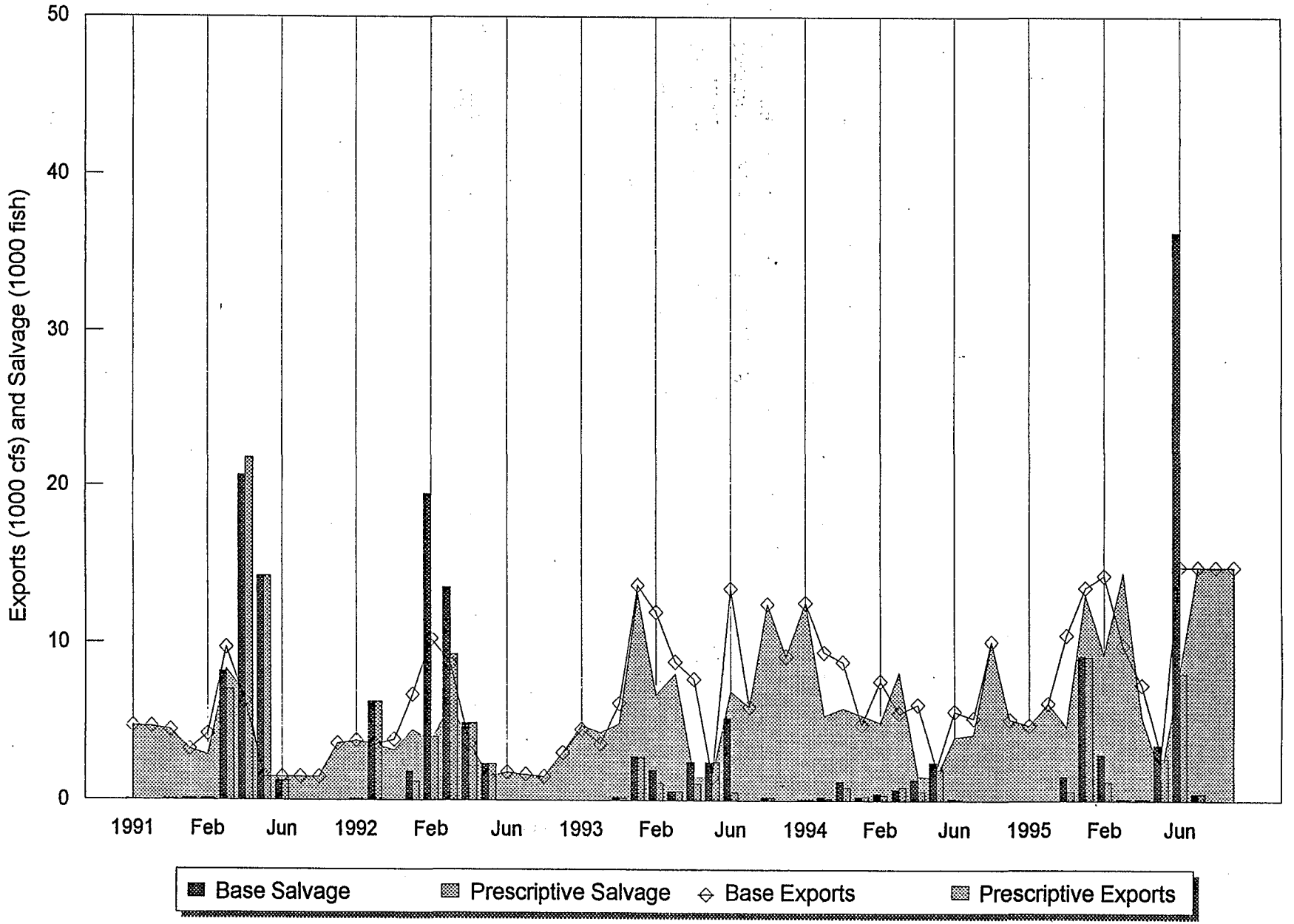
Chinook Benefits from EWA Game 2

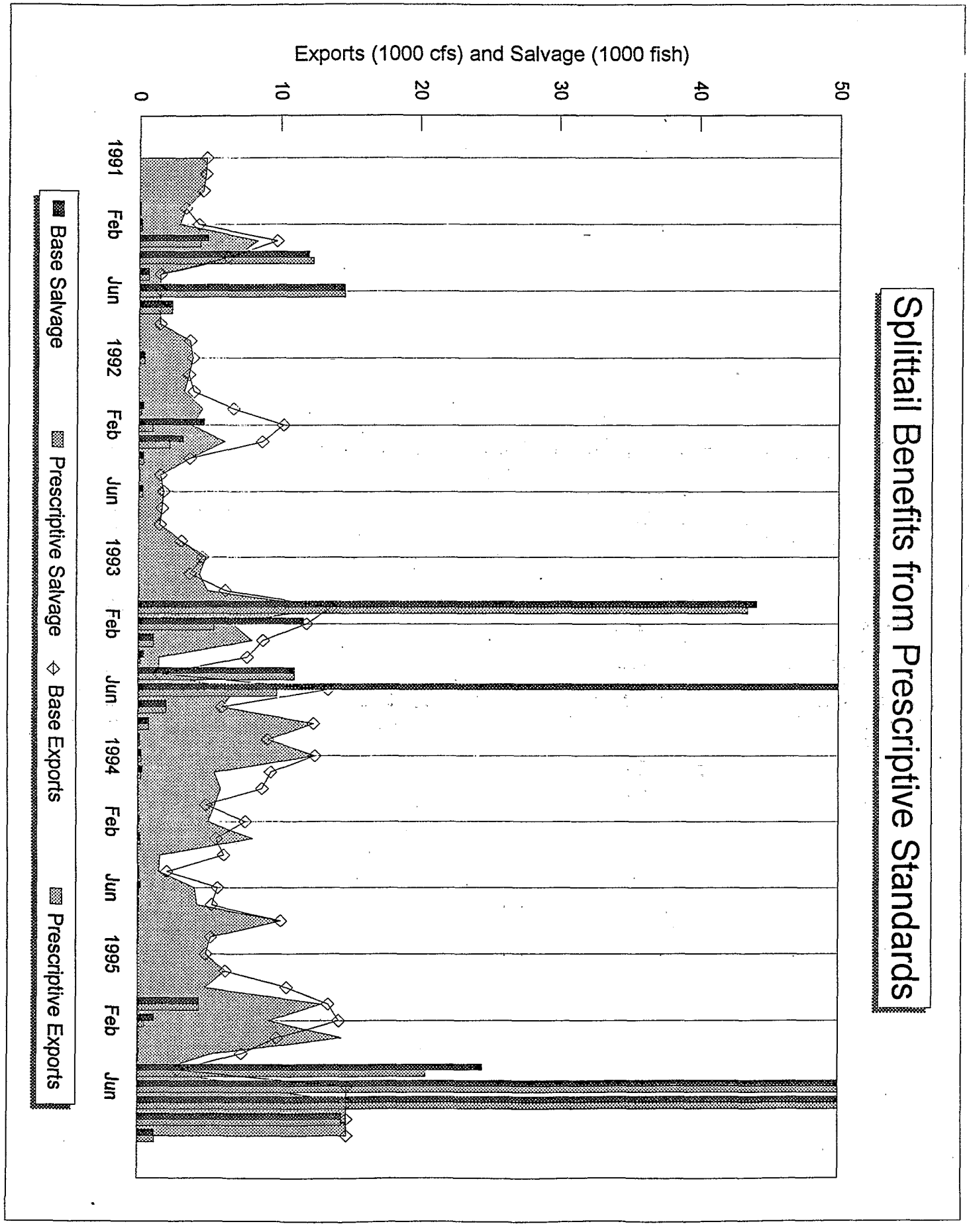


Splittail Benefits from EWA Game 2



Chinook Benefits from Prescriptive Standards




Splittail Benefits from Prescriptive Standards
Exports (1000 cfs) and Salvage (1000 fish)
0
10
20
30
40
50
1991
Feb
Jun
1992
Feb
Jun
1993
Feb
Jun
1994
Feb
Jun
1995
Feb
Jun
Base Salvage
Prescriptive Salvage
Base Exports
Prescriptive Exports

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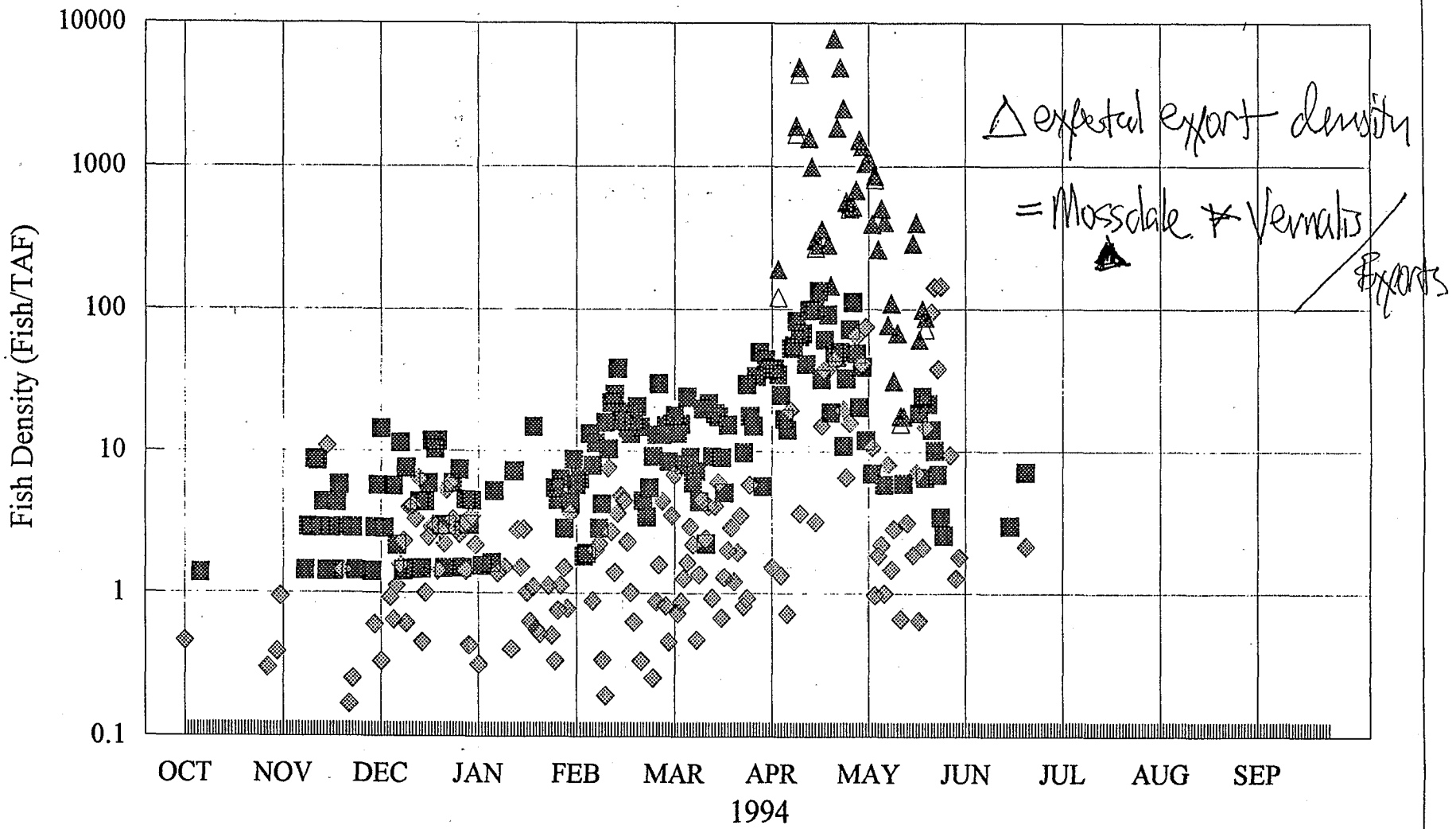
Chinook Density Pattern



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Game 3

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Game 3 - Credit Approach

Basic Description: Game 3 represents the credit approach, wherein the EWA would not retain assets. JPOD, Delta island storage, groundwater banks would be available, but all for the projects. E/I 21,000 cfs export capacity including 6000 to islands

Beginning Assets:

- $30 million annual fund for EWA purchases.
- Ground Water Banks (Projects)
  - Kern (300 TAF of storage space available with 20 TAF/mo in and out limits)
  - Gravelly Ford (300 TAF of storage space available with 20 TAF/mo in and out limits)
- Expanded Shasta (50 TAF per year - projects)
- Debt carrying ability in project reservoirs (primarily San Luis and Shasta)
- Delta Islands evapotranspiration savings to EWA (15 for projects; 45 TAF/year for EWA)
- Delta Island storage connected to CCF (200 TAF, 60 TAF in or out per month limitation)
- $ 3 million for WQ purchases.

Asset Generating Capability:

- Pumping unused capacity to erase debts.

Baseline Conditions: Accord + AFRP, JPOD

- 1995 demand level
- 10,300 cfs expanded capacity for Banks pumping plant
- Delta island storage, Banks, and Tracy intakes are all screened.
- 320 TAF of Delta storage for projects (60 TAF in/out limit per month)

Actions Taken:

- Reduced exports at various times by using credits accumulated or accumulating debt.
- Purchased export area water to pay back EWA debt in San Luis.
- Purchased water from Sacramento and San Joaquin for release to rivers and Delta, and payment of debt in San Luis.

Water Operations Summary: Gaming Exercise
April 19, 1999 Draft GAME 3 "CREDIT APPROACH"

Scenario: April	Debit Approach		Target Year: End of Stage 1
Water Supply Measures	Details	EWA/ Users Division	How to Model How to Game
South Delta Program - 10.3 kcfs	10.3 kcfs	Projects	Model in baseline.
JPOD. No individual State/ Federal sublimits	No state or federal sublimits apply	Projects	Model in baseline.
Eliminate E/I			Model in baseline.
Kern Water Bank	300 kaf storage. 20 kaf/ month in. 20 kaf /month out.	Projects	Model in baseline.
Gravelly Ford Groundwater	300 kaf storage. 20 kaf/ m in/out	Projects	Model in baseline.
Shasta Dam Expansion	50 kaf storage	Projects	Model in baseline
Webb Tract	120 kaf. 2 kcfs in/out	Projects	Operate by hand under Delta Wetlands rules.
Bacon, Woodward, Victoria	200 kaf. 4 kcfs in from Delta. 2 kcfs 2-way connector with Clifton Court	Projects	Operate by hand. Project rights plus Delta Wetland rules
Credit/ Debit Account	Right to reduce export pumping each year up to account total. Non accumulating.	EWA	Still being finalized. Each September, EWA gains credits against export projects. Amount to be supplied prior to game.
ET reductions on Delta islands	60 kaf/year average	Projects	Operate by hand in game.
SOD water purchase options	No limit, but see price schedule	EWA	Operate by hand in game
NOD water purchase options	No limit, but see price schedule.	EWA	Operate by hand in game
Spot Purchases	No limit, but see price schedule	EWA	Operate by hand in game.
Screens at Delta export intakes			Assumed in place for game.

Notes

1. Remaining issues, notes:

- o Groundwater input/output capacities
- o New cost schedules (below) for purchases, pumping, etc.
- o CALFED plans to fund on the order of 150 kaf/yr of efficiency improvements. Can those be credited to project yield?

Initial Conditions

Assume that EWA starts w/ $30 million.

EWA Budget

$30 million/year, paid on October 1 of each year. Funds may accrue. The EWA may borrow up to $30 million of future income. EWA funds accrue interest at 5% per year. Borrowing costs 5% per year.

Price Schedules

Discretionary and operating costs must be paid for using the EWA budget. These costs include:

o Cost of options
o Cost of purchases

Assumed prices:

1. Options

   $10/af for water to be delivered next year. Options must be purchased before October 1.
   $60/af to call options upstream of the Delta.
   $100/af to call options in export areas
   All options must be called before April 1 or the water reverts to the seller.

The price of options is doubled during dry and critical years. The price of calling options rises by 50% during dry and critical years (when projections are greater than 50% for dry or critical

2. Spot purchases

   $200/af for the first 200 kaf/yr
   $300/af for the next 200 kaf/yr
   etc.

   Add $100/af during years projected to be dry and critical with > 50% probability.

3. Water/ credit sales by EWA

   Price to be negotiated during game.

Water Quality Account

Up to $3 million/yr. Account does not accrue

Modeling Basis

Based upon the matrix above, the modeling upon which the game would be founded would be run with the following assumptions:

- 1995 Level of Development?
- Accord + VAMP
- All AFRP
- Trinity
- South Delta Improvements (10.3 kcfs)
- Unlimited JPOD
- Gravelly Ford storage (300 kaf)
- Kern Water Bank Storage (300 kaf)

- o Shasta storage (50 kaf)
- o Eliminate E/I

Water Supply Evaluation

The results from the modeling basis

plus: (1) water developed at the Delta island storage sites; (2) ET gains; and (3) any efficiency water allocated to the Projects

minus delivery reductions caused by use of the EWA credits

will roughly represent estimated Project deliveries

Game Rules

- o Movement of water through the Delta when outflow is controlling has a carriage water cost of 20%. Backing water upstream via export reductions when outflow is controlling reduces carriage water by 20%.
- o EWA credits/ debits do not accumulate, but may be sold. Sales prices may be negotiated during the game.
- o EWA may reschedule flows, provided that the EWA can assure "no harm".
- o EWA may use unused capacity in state and federal facilities, but has low priority.

GAME 3. "CREDIT APPROACH"

Reconstruction	Water Year		1991	Values in italics are calculated									
		IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Available Credit			147	147	142	134	128	110	145	155	155	155	155	155
Credits used by month								21	0	0	0	0	0	0
Cumulative per year								119	145	145	145	145	145	145
credit balance								-9	0	10	10	10	10	10
Change in Shasta Releases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*25*	*0*	*0*	*0*
Sacramento River Market Releases			0											
San Joaquin River Market Releases			0					50	50					
Delta Cross Channel Closed?														
Bacon Island Diversions														
Pumping from/to Bacon to/from CCFB			*0*	*100*	*0*	*0*	*0*	*-120*	*60*	*60*	*0*	*0*	*0*	*0*
Webb Tract Diversions														
Diversion to Island		60	0	0	0	0	0	0	0	0	0	0		
Release for export				60	0	0	0	0	0	0	0	0		
Change in CCFB/Tracy Diversions														
Total Change in Delta Diversions														
Divert for EWA from Store/buy, surplus E/I relaxation			0											
Carriage Water										0	5			
Change in Delta Outflow			*0*	*0*	*0*	*0*	*0*	*50*	*50*	*0*	*25*	*0*	*0*	*0*
South of Delta market "deliveries"			0						0	25	25	25	25	
MWD Shift Water to/from EWA														
Change Groundwater Storage			*0*	*40*	*0*	*0*	*0*	*0*	*-40*	*-40*	*-40*	*-20*	*0*	*0*
Change in San Luis Storage			*0*	*120*	*0*	*0*	*0*	*-120*	*0*	*0*	*0*	*0*	*0*	*0*
EWA Debt in San Luis								9	100	75	50	25	0	
End of Month Values for EWA Accounts			0											
	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		25	25	25	25	25	25	25	25	25	0	0	0	0
Bacon Storage		100	100	0	0	0	0	120	60	0	0	0	0	0
Increased deliveries									100	100	60	20	0	0
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	50	50	70	70	70	70	70	50	30	10	0	0	0
Gravelly Ford	100	50	50	70	70	70	70	70	50	30	10	0	0	0
Project Deviations in San Luis		0	0	120	120	120	120	0	0	0	0	0	0	0
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0	0
Purchased	*$/af dry adder*													
Year Type: 1 for dry/critical. 0 otherwise			*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10	10	100											
Option San Joaquin	10	10	100											
Option Export	10	10	100											
Spot Sacramento	200	100												
Call Sacramento	60	30						100						
Spot San Joaquin	200	100												
Call San Joaquin	60	30						100						
Spot export area	200	100												
Call export area	100	50						100						
Purchased but undelivered														
Sacramento		*0*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*50*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*100*	*100*	*75*	*50*	*25*	*0*	*0*
Sum of undelivered Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*250*	*200*	*175*	*150*	*125*	*100*	*100*
Cost of Purchases			*3*	*0*	*0*	*0*	*0*	*33*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*4*	*4*	*4*	*2*	*0*	*0*
Payments to EWA			*30*								12.5			
Interest														
Financial Balance		*0*	*27*	*27*	*27*	*27*	*27*	*-6*	*-6*	*-6*	*6.5*	*6.5*	*6.5*	*6.5*
Approximate Water Buying Power after pumping costs		*0*	*102*	*78*	*78*	*78*	*78*	*0*	*0*	*0*	*27*	*39*	*39*	*39*
Water Quality purcha millions		3												
amount cfs		500												
amount TAF		32												
Water Quality Optior TAF			90											
cost $m			1.8											
water quality call on opitons	TAF								90					
	cost $m								1.8					
Releases for water quality												30	30	30
Balance												60	30	0

Water Quality to San Luis from purchase of Yuba carriage water

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Reconstruction	Water	1992		Values in italics are calculated									
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Available Credit		129	132	128	123	121	155	174	185	156	139	137	137
Credits used by month													
Cumulative per year													
credit balance													
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Bacon Island Diversions													
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island						0							
Release for export													
Change in CCFB/Tracy Diversions													
Total Change in Delta Diversions													
Divert for EWA from Stora/buy, E/I relaxation													
Carriage Water													
Change in Delta Outflow		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
EWA Debt in San Luis													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta													
Bacon Storage													
increased deliveries													
SemiTropic	200												
Kern	100												
Gravelly Ford	100												
Project Deviations in San Luis													
Borrowed MWD													
Purchased	*$/af*												
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10												
Option San Joaquin	10												
Option Export	10												
Spot Sacramento	200												
Call Sacramento	60												
Spot San Joaquin	200												
Call San Joaquin	60												
Spot export area	200												
Call export area	100												
Purchased but undelivered													
Sacramento		*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*0*	*-0.6*										
Interest		*0.6*											
Financial Balance		*6.5*	*5.9*	*5.9*	*5.9*	*5.9*	*5.9*	*5.9*	*5.9*	*5.9*	*5.9*	*5.9*	*5.9*
Approximate Water Buying Power after pumping costs		*39*	*35.4*	*35.4*	*35.4*	*35.4*	*35.4*	*35.4*	*35.4*	*35.4*	*35.4*	*35.4*	*35.4*
Water Quality purch millions													
amount cfs													
amount TAF													
Water Quality Optior TAF							90TAF						
cost $m							8.1m						
water quality call on opitons	TAF											30	30
	cost $m												
Releases for water quality													
Balance													
Water Quality to San Luis from purchase c													
carriage water													

Reconstruction	Water	1993	Values in italics are calculated										
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Available Credit		125	126	122	138	218	267	379	461	511	511	511	511
Credits used by month					138	80	49	112	82	50	0	0	0
Cumulative per year					138	218	267	379					
credit balance					0	0	0	0	0	0	0	0	0
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases									0	50			
San Joaquin River Market Releases								50	50	50			
Delta Cross Channel Closed?													
Bacon Island Diversions													
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*-80*	*-120*	*0*	*20*	*120*	*0*	*60*	*0*	*0*
Webb Tract Diversions													
Diversion to Island					40	60							
Release for export											100		
Change in CCFB/Tracy Diversions													
Total Change in Delta Diversions													
Divert for EWA from Store/buy, E/I relaxation													
Carriage Water											15		
Change in Delta Outflow		*0*	*0*	*0*	*-40*	*-60*	*0*	*50*	*50*	*100*	*0*	*0*	*0*
South of Delta market "deliveries"									50	50	50		
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*40*	*40*	*40*	*40*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*0*	*0*	*-40*	*-40*	*80*	*40*	*-40*	*0*	*0*	*0*	*0*
EWA Debt in San Luis					-307	-377	-328	-216	-84	16	66	66	66
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta													
Bacon Storage					80	200	200	180	60	60	0	0	0
Increased deliveries								20	120	0	160	0	0
SemiTropic	200												
Kern	100				20	40	60	80	80	80	80	80	80
Gravelly Ford	100				20	40	60	80	80	80	80	80	80
Project Deviations in San Luis					-40	-80	0	40	0	0	0	0	0
Borrowed MWD													
Purchased	*$/af*												
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Option Sacramento	10	50											
Option San Joaquin	10	100											
Option Export	10	150											
Spot Sacramento	200												
Call Sacramento	60							50					
Spot San Joaquin	200												
Call San Joaquin	60							100					
Spot export area	200												
Call export area	100					150							
Purchased but undelivered													
Sacramento		*100*	*100*	*100*	*100*	*100*	*100*	*150*	*150*	*100*	*100*	*100*	*100*
San Joaquin		*0*	*0*	*0*	*0*	*0*	*0*	*50*	*0*	*-50*	*-50*	*-50*	*-50*
Export area		*0*	*0*	*0*	*0*	*150*	*150*	*150*	*100*	*50*	*0*	*0*	*0*
Sum of undelivered Purchases		*100*	*100*	*100*	*100*	*250*	*250*	*350*	*250*	*100*	*50*	*50*	*50*
Cost of Purchases		*3*	*0*	*0*	*0*	*15*	*0*	*9*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*0.3*											
Financial Balance		*32.9*	*32.9*	*32.9*	*32.9*	*17.9*	*17.9*	*8.9*	*8.9*	*8.9*	*8.9*	*8.9*	*8.9*
Approximate Water Buying Power after pumping costs		*197.4*	*197.4*	*197.4*	*173.4*	*59.4*	*35.4*	*0*	*0*	*0*	*0*	*0*	*0*
Water Quality purchs millions													
amount cfs													
amount TAF													
Water Quality Optior TAF													
cost $m													
water quality call on opitons	TAF	30											
	cost $m												
Releases for water quality													
Balance													
Water Quality to San Luis from purchase c												36	
carriage water												9	

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Reconstruction	Water	1994	Values in italics are calculatec										
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Available Credit		260	264	260	264	269	271	276	269	251	236	230	230
Credits used by month		0	0										
Cumulative per year credit balance		260	260										
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Bacon Island Diversions													
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Webb Tract Diversions													
Diversion to Island													
Release for export													
Change in CCFB/Tracy Diversions													
Total Change in Delta Diversions													
Divert for EWA from Store/buy, E/I relaxation													
Carriage Water													
Change in Delta Outflow		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*40*	*-200*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*-40*	*40*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
EWA Debt in San Luis		66	66	0									
End of Month Values for EWA Accounts	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta													
Bacon Storage		0	0										
increased deliveries		0	0										
SemiTropic	200												
Kern	100	80	100										
Gravelly Ford	100	80	100										
Project Deviations in San Luis		0	-40	0									
Borrowed MWD													
Purchased	*$/af*												
Year Type: 1 for dry/critical. 0 otherwise		*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Option Sacramento	10	50											
Option San Joaquin	10	100											
Option Export	10	150											
Spot Sacramento	200												
Call Sacramento	60												
Spot San Joaquin	200												
Call San Joaquin	60												
Spot export area	200												
Call export area	100												
Purchased but undelivered													
Sacramento		*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
San Joaquin		*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of undelivered Purchases		*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cost of Groundwater Pumping		*0*	*0*	*20*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*30*											
Interest		*0.9*											
Financial Balance		*38.9*	*38.9*	*38.9*	*38.9*	*38.9*	*38.9*	*38.9*	*38.9*	*38.9*	*38.9*	*38.9*	*38.9*
Approximate Water Buying Power after pumping costs		*137.4*	*113.4*	*233.4*	*233.4*	*233.4*	*233.4*	*233.4*	*233.4*	*233.4*	*233.4*	*233.4*	*233.4*
Water Quality purchs millions													
amount cfs													
amount TAF													
Water Quality Optior TAF													
cost $m													
water quality call on opitons	TAF												
	cost $m												
Releases for water quality													
Balance													
Water Quality to San Luis from purchase c			-36										
carriage water													

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Reconstruction Water 1995 Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
Available Credit		125	125	125	165	450	440	511	511	511	511	511	511		
Credits used by month															
Cumulative per year															
credit balance															
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Sacramento River Market Releases															
San Joaquin River Market Releases															
Delta Cross Channel Closed?															
Bacon Island Diversions															
Pumping from/to Bacon to/from CCFB		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Webb Tract Diversions															
Diversion to Island															
Release for export															
Change in CCFB/Tracy Diversions															
Total Change in Delta Diversions															
Divert for EWA from Store/buy, E/I relaxation															
Carriage Water															
Change in Delta Outflow		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"															
MWD Shift Water to/from EWA															
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Change in San Luis Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
EWA Debt in San Luis															
End of Month Values for EWA Accounts	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
EWA Shasta															
Bacon Storage															
increased deliveries															
SemiTropic	200														
Kern	100														
Gravelly Ford	100														
Project Deviations in San Luis															
Borrowed MWD															
Purchased	*$/af*														
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Option Sacramento	10														
Option San Joaquin	10														
Option Export	10														
Spot Sacramento	200														
Call Sacramento	60														
Spot San Joaquin	200														
Call San Joaquin	60														
Spot export area	200														
Call export area	100														
Purchased but undelivered															
Sacramento		*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*		
San Joaquin		*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*	*-50*		
Export area		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Sum of undelivered Purchases		*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*		
Cost of Purchases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*		
Payments to EWA		*30*													
Interest		*1.9*													
Financial Balance		*68.9*	*68.9*	*68.9*	*68.9*	*68.9*	*68.9*	*68.9*	*68.9*	*68.9*	*68.9*	*68.9*	*68.9*		
Approximate Water Buying Power after pumping costs		*413.4*	*413.4*	*413.4*	*413.4*	*413.4*	*413.4*	*413.4*	*413.4*	*413.4*	*413.4*	*413.4*	*413.4*		
Water Quality purchs millions															
amount cfs															
amount TAF															
Water Quality Optior TAF															
cost $m															
water quality call on opitons TAF															
cost $m															
Releases for water quality															
Balance															
Water Quality to San Luis from purchase c															
carriage water															

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Game 3: 1992 Credit Approach

October	Exports 3525, outflow 5431, X2 85.8, E/I 34%... Model Run 836.. Outflow is controlling. San Luis is low, thus no WS actions. No action on fish. No WQ actions.
November	Initial conditions: Exports 3424, outflow 3494, X2 87.7, E/I 43%.. Moved 60 from Webb to San Luis (20), 20 Kern, 20 to Gravelly Ford; thus increasing exports by 1000 = 4424 cfs. Moved 100 from Bacon to SL. No actions for fish or WQ.
December	Exports 5212, outflow 3496, X2 88.4, E/I 54%... No WS action. No fish action or WQ actions.
January	Exports 3889, outflow 4748, X2 86.3, E/I 44%. No WS action. Not predicting filling SL. No actions for fish or WQ.
February	Exports 150 (monthly)/6000 (daily), outflow 11934, X2 78.5, E/I 1%. Outflow is controlling exports. Early February flow pulse could be exported in daily model. Put exports in SL. 350TAF extra exported above DWRSIM to SL. No actions for WS. EWA Credit could be more for this extra water. No WQ or Fish action.
March	Exports 14446, outflow 22227, X2 71.2, E/I 40%. QWEST below 0 in first half of month. Last week can pump 21TAF WS to DW islands. Delivered 50 TAF of San Joaquin options for fish, particularly salmon survival. Called all fish options 300 TAF. Credits used to limit total exports to 15,000 cfs – no pumping to DW. WQ no action. Back water into Bacon (120) or other SOD storage instead of putting into San Luis is an option if we think SL would fill. Reduced pumping to 10 k for 10 days – used 100 TAF of credits.
April	Exports 6920, outflow 11105, X2 74, E/I 35%. Outflow limits in first half of April, then Vamp takes over in second half. Chipps satisfied from March actions. Moved water from San Luis and GW to deliveries (60, 40). WQ called 90 TAF of options. Delivered 50 TAF of San Joaquin options for fish in first two week to increase outflow and QWEST. Reduce exports by 4200 in first half of month using 100 TAF of SOD options called in March plus 26 credits.
May	Exports 3287, outflow 5902, X2 79.9, E/I 28%. Moved 60 k from Bacon and 40 from GW to deliveries. No actions.
June	Exports 219, outflow 6000, X2 81.6, E/I 2%. Moved 40 TAF from GW to deliveries for WS. No WQ actions. Fish sell 100 TAF to WS at 12.5 million dollars to be pumped in August to limit pumping in June.
July	Exports 127, outflows 4000, X2 85.4, E/I = 1 %. WQ released 30 TAF from Yuba to outflow, 500 cfs increase in outflow.
August	Export 1571, outflow 2992, X2 88.8 (88.0), E/I = 21%. WQ released 30 TAF from Yuba to outflow, 500 cfs increase in outflow.

September	WQ released 30 TAF from Yuba to outflow, 500 cfs increase in outflow.
Yearly totals	

Game 3: 1993 Credit Approach

October	Exports 3994, outflow 5480, E/I 37%, X2 86. Fish 300 TAF options. WQ 90TAF options.
November	Export 4000, outflow 3500, X2 88, E/I 51%. No actions.
December	Exports 13705 (8500), outflow 3496, E/I 80%, X2 88.4. No actions.
January	Exports 14473, outflow 54845, X2 67.5, E/I 23%. 120 TAF to islands in last 10 days. 40 TAF to SL, 20 TAF each to GF and Kern. Reduced export diversions by 50% for winter run, delta smelt and splittail. Assuming that take limits are in place and protecting. Did not cut island diversions.
February	Exports 14547, outflow 47520, X2 62, E/I 25%. 180 TAF to DW, 20 TAF each to Kern and GF. Called 150TAF and took 150 TAF from SL. Exports cut 150 TAF.
March	Exports 8800, outflow 34700, E/I 20%, X2 62.3. Pumped 40 to GW and 120 to San Luis to make up for deviations for GW hole. Export pumping capacity high – but unused. Could pump to erase some of debt, but do not.
April	Exports 8154, outflow 38220, X2 62, E/I 17%. Pump 40 TAF to GW in first half; transfer 20 TAF from Bacon in second half to deliveries. Use 50 TAF on San Joaquin to increase outflow in first half of month. No export reductions for fish.
May	Exports 5500, outflow 29500, E/I 15%, X2 64. 50 k SOD credits and new credits reduce SL debt. Bacon 120 k to deliveries. No export reductions.
June	Exports 14900, outflow 16700, E/I 42%, X2 69. 50 SJ options, 50k Sac options
July	Exports 5500, outflow 8000, E/I 30%, X2 76. Fish no action, 100 TAF from Webb to deliveries, 60 TAF from Bacon to deliveries.
August	Exports 13,564; outflow 4098, E/I 65%, X2 83.3 WS no action. Fish no action. WQ moved 45TAF from Yuba to SL.
September	Exports 11178, outflow 3000, E/I 68%, X2 88 No actions.
Yearly totals	

Game 3: 1994 Credit Approach

October	Exports 14600, outflow 4000, E/I 73%, X2 88.
November	Exports 9228, outflow 4500, E/I 63, X2 86 WS 40TAF from SL to GW. Fish close DCC which could cause WQ impact. Cut exports by releasing WQ 36 TAF in San Luis to deliveries.
December	Exports 13749, outflow 4600, E/I 86, X2 86
January	
February	
March	
April	
May	
June	
July	
August	
September	
Yearly totals	

GAME 3 - BIOLOGICAL

***** USE OF THE "CREDITING" APPROACH *****

BIOLOGICAL ISSUES / RATIONALES

BACKGROUND:

- Quinn/Spear tomorrow, they would like to have a little more detail, including rationales
- Need a draft report by 10 May
- Then to BDAC, etc.
- EIS/IER due by the first of June.
- Need to address "negotiating points" and other forms of flexibility (*e.g.* trading water quality against fish protection).
- Philosophy behind the "crediting" approach questions the need for new facilities to address environmental issues; "facilities" are part of the problem.
- Operating flexibility and relaxation of the prescriptive rules will be used as debits and credits to shut down pumping on a "real time" basis.
- There will probably be more changes in operations in the water supply perspective than in the fish perspective.
- Credits will be allocated according to a water year, not a "delivery year"
- Use base study 816 (Accord + AFRP)
- Also, increase in Banks to 8,500; unlimited joint point; ability to relax E/I
- [see handouts]
- Starting credits are unknown in October, since there is no available 4-Rivers Index.
- Water supply assets are in the model base run and some must be done by hand; see "Credit Approach" handout chart.
- Credits exist for the EWA since the Projects are "allowed" to implement water supply assets (*e.g.* 8,500 cfs capacity at Banks; unlimited joint-point; etc. A dummy run was used to quantify the initial credits, based on the amount of increase in water supplies the supply assets would generate.
- Model has South Delta at 10.3 KAF; JPOD; eliminate E/I; 200 KAF at Kern;
- Do 100 TAF (each) at Gravelly Ford and Kern (extra); all delta storage (120 KAF at Webb, 200 KAF at Bacon); Shasta at 50 KAF by hand.
- EWA still has $30 million and can buy options, etc.
- All delta storage belongs to the Projects.

GAME 3

October, 1991

- EWA will buy options immediately (100 on SJR; 100 on Sacramento; 100 in export areas)
- Initial conditions are the same as in Game 2: All storage areas (*e.g.* delta islands, x-tra Shasta, groundwater banks, etc.) starts half-full.
- Water users will buy 90 KAF for water quality.
- Exports = 3,525
- Outflow = 5,431
- E/I irrelevant, but 34%
- X2 = 85.8
- Credits = 147 KAF
- Outflow (chloride conditions) is controlling
- Fish: nothing happening; no actions
- Water users: *Could* transfer some water from San Luis to groundwater...transferring would result in water quality degradation, and since San Luis is only half full, this would not be a good idea; if San Luis was fuller, the transfer might be a good idea.

November 91

- Exports = 3,424 (changes to 4,424 when Webb water moved by water users; see below)
- Outflow = 3,494
- (E/I = 43%)
- X2 = 87.7
- EWA Credits unchanged at 147 KAF
- Fish: nothing happening; no actions
- Water users; move Webb Is (40 KAF (?))and Bacon Is (100 KAF) water to San Luis, except 40 KAF which go to Gravelly Ford and Kern (20:20) (see poster notes)

December 91

- Exports = 5,212
- Outflow = 3,496
- (E/I = 54%)
- X2 = 88.4
- Credits decreased to 142 (because it did not rain in December)
- Water users: Hard to move Shasta water because of Keswick Release restrictions (no rain yet); no actions
- Two small storm events are pumped, since E/I no longer is relevant; no *apparent* effect on water quality

- Fish actions: Issue is identified...E/I is calculated using an averaging period. Short storms can be "followed" rather effectively by exporters, resulting in a relatively constant outflow, even when there are "spikes" in inflow. Possible to export more than inflow if the rain is a delta event. No fish actions.
- Water quality: *Could* take some risk and wait to fill San Luis, but this would be too much risk. No action.

January 92

- Exports = 3,889
- Outflow = 4,748
- (E/I = 44%)
- X2 = 86.3
- Credits = 134 (continuing to decline...no rain)
- Water Supply: This is allocation season, but not enough water in the system to change anything. No actions.
- Fish actions: No actions
- Water Quality: No actions

February 92

- Exports = 150
- Outflow = 11,934; goes to 9,100 when storm is pumped (see below)
- (E/I = 1%)
- X2 = 78.5
- Credits = 128
- Water Supply: Outflow is controlling. Can pump a small storm. The DWRSIM model is trying to meet Collinsville; Russ' model isn't, so the daily model shows pumping the small storm can be pumped = 6,000 for the month. Put into San Luis (350 KAF of exports not in George's model...keep track; could lead to invalid comparisons of water supply impacts when results are "post-processed"). No additional actions.
- Fish actions: No actions.
- Water Quality: No actions...too much conflict between supply and quality.

March 92

- Exports = 14,446
- Outflow = 22,227
- (E/I = 40%)
- X2 = 71.2
- Credits = 110

- Water Supply actions: Fill delta islands at 6,000 cfs during last week of the month...Bacon = 56 KAF; Webb 28 = KAF. Chlorides are falling. This taken away by fish actions (see below).

- Fish actions: *Could* stop the filling of the delta islands in the last week of the month by expending 84 KAF of the 110 KAF of available credits. Action: Call SJR options and exercise 50 KAF by releasing about 900 cfs for the month. Call all options (has to be done by April anyway). Purpose is to benefit salmon (both sides); benefit not modeled, but the intent is to increase central delta survival through "hydrodynamic benefits" (less Sacramento River water going to the pumps). X2 would probably move downstream a little, but Water Users decided to ignore this and not pump this extra SJR water. Action: Use the 84 KAF to reduce delta island filling (see above).

- Water Quality: Chlorides are falling, especially late in the month; *probably* no actions (Briggs out of the room).

- Water users: *Could* move water through San Luis into groundwater, but there is a model conflict regarding whether San Luis is full or not. If San Luis is really full, the decision would be to pass 40 KAF into groundwater. Also, *could* back 2,000 cfs into delta island storage via Clifton Court (backward through the connector). *Could* move water over the Tehachapi's to storage in Southern California (*e.g.* Eastside, etc.) if there is room available. *N.B.:* If San Luis is not full, maximum pumping would go to San Luis.

- The net result of all this is that the 21,000 cfs of *total* export capacity is held to 15,000 cfs by the Fish Action and the expenditure of credits. Net result isn't very good for fish, in spite of the expenditure of credits.

- A rule applies to Delta Wetlands: fish trigger can limit exports onto islands to 50% of SJR flow for 15 days at Vernalis (if fish are present). Vernalis flow, end of March, is relatively high. This results in a "hit" to the EWA of 21 KAF if the pumping to the islands is curtailed (as above).

- Fish Actions: Reduce pumping for the last 10 days of the month to 10 kcfs; cost = 98 KAF. Balance = -10 KAF. Balanced by giving up some South of Delta options (incur a debt in San Luis of 9 KAF to be paid back later). New balance = 0.

April 92

- Exports = 6,920

- Outflow = 11,105

- (E/I = 35%)

- X2 = 74.1

- Credits = 26 KAF (35 KAF new credits less 9 KAF to pay back the 9 KAF San Luis debt)

- Outflow controlling first half of the month; VAMP controlling second half of the month.

- Water Supply: Projects have 120 KAF in Bacon which could be moved...Decision: Move Bacon water to deliveries (60 KAF). Also pull out 20:20 from Gravelly Ford and Kern to deliveries. Therefore, San Luis stays where it is. This has been a benefit to the Projects.

- Water Quality: Call all 90 KAF options (probably use them in the summer).

- Fish Actions: Augment SJR flows through the use of 50 KAF of options for first 2 weeks (ahead of VAMP) to increase outflow and Q-west.

- Reduce exports by 3 kcfs for 15 days through use of remaining 26 KAF credits and 64 KAF SOD options. Purpose is to bridge March protections to the onset of VAMP (delta hydrodynamics; X2; etc.). Spend 100 KAF of SOD options. Total spent = 126 KAF. Pumping reduced by 4,200 cfs for 15 days.

May 92

- Exports = 3,287
- Outflow = 5,902
- (E/I = 28%)
- X2 = 79.9
- Credits = 10 (increase from last month)
- Water users: Move remaining Bacon Is. water to deliveries (60 KAF)
- Take 20:20 out of Kern and Gravelly Ford to deliveries.
- Water Quality: No actions
- Fish Actions: No actions; let VAMP work; X2 is 10 km downstream of historical location (there is an artifact in the model in the difference between the "base" and "modeled" location of X2

June 92

- Exports = 219
- Outflow = 6,082
- (E/I = 2%)
- X2 = 81.6
- Credits = 10 (carry over from last month)
- Water Supply: Move 20:20 of groundwater to deliveries
- Move all 25 KAF out of Shasta to deliveries (actually 21 KAF gets to deliveries because of carriage water). So far, the increase in overall deliveries is 260 KAF.
- Water Quality: No actions.
- EWA: *Could* sell some water (*e.g.* options on the Sacramento River side plus Shasta water. Price is about $125/ac-ft. Action: Do it...sell 100 KAF to "exporters". Rationale: take the money now and avoid the risk of spilling in the winter and losing it; buy it back the next year. Original cost was $20 for the option and $90 for the water = $110. The decision is made to sell in June to deliver the water in or before August. Credit EWA with $1.25 million.

July 92

- Exports = 127
- Outflow = 4,000
- (E/I = 1%)
- X2 = 85.4

- Credits = 8 (10 carryover less a 2 credit decrease from last month). Water users decided to "let it slide" → leave the credits at 10 KAF
- Water Supply: Pull the remaining groundwater out into deliveries: 10:10 (total = 20 KAF)
- Water Quality: Spend 30 KAF of the water quality options (90 - 30 = 60 remaining). Goes directly to outflow, moving X2, etc. (fish benefit).
- Fish actions: No actions.

August 92

- Exports = 1,571
- Outflow = 2,992
- (E/I = 21%)
- X2 = 88.8 less the water quality outflow influence from the previous month.
- Water Quality: Spend another 30 KAF from NOD options (Yuba).
- Pump 80 KAF plus 20 carriage water from purchases NOD.
- Fish Actions: No actions.

September 92

- Exports =
- Outflow =
- (E/I =)
- X2 =
- Water Quality: Use the remaining 30 KAF from options NOD (Yuba) (goes to outflow)
- EWA has 10 remaining credits left over from May...Decision: let them lapse. Probably would have used them in June (if paying attention).

WATER YEAR 1993

October 92

- Exports = 3,994
- Outflow = 5,480
- (E/I = 37%)
- X2 = 85.7
- Credits = 125
- Assume exporter's storage at the end of 1992 is zero.
- Seventh dry year in a row !!
- Water Supply:

- Water Quality: purchase 90 KAF
- EWA: Purchase options – 50 KAF on the Sacramento side; 100 KAF on the SJR side; 150 KAF in the SOD area.
- Fish actions: No actions

November 92

- Exports = 4,019
- Outflow = 3,494
- (E/I = 51%)
- X2 = 87.7
- Credits = 126
- Water Supply: No actions available
- Water Quality: No action
- EWA: No actions
- Fish Actions: No actions

December 92

- Exports = 13,705 (N.B. No carriage water assumed) **N.B.: Daily model shows 8,500**
- Outflow = 3,496 (Exports are 4x outflow!)
- (E/I = 80%)
- X2 = 88.4
- Credits = 122 (dry November)
- Chlorides limiting.
- Water supply: No action (could have moved some water from San Luis, but can't anticipate much. Do this next month).
- Water quality: No action
- Fish actions: No action – Fish don't show up until after the water is pumped...later in the month.

January 93

- Exports = 14,473
- Outflow =54,845
- (E/I = 23%)
- X2 = 61.5
- Credits = 138 (with confidence that they will increase...snow pack)
- Water supply: Maximum pumping and storage: 4 kcfs to Bacon; 2 kcfs to Webb for 10 days (after X2 passes Chipps for 10 days); transfer maximum (20:20) from San Luis to groundwater.

- Water quality: No actions
- Fish actions: Only a few salmon are showing up at the pumps...hatchery fish. Many splittail show up near the end of the month. Delta smelt also start showing up near the end of the month. Took extraordinary measures to protect winter run, plus splittail and dleta smelt. Reduced exports by 50%. Cost = 445 KAF. Spend all 138 credits and go into debt by 307 credits (San Luis debt). The export "cut" is at the South Delta pumps...delta islands still are filled. The debt is mostly covered by options less carriage water. All this assumes that take limits would not have been exceeded. Since there are state-of-art screens present, and since delta smelt are present in relatively low numbers, it may be that take limits would not be exceeded. Can't be sure either way.

February 93

- Exports = 14,547
- Outflow = 47,520
- (E/I = 25%)
- X2 = 61.8
- Credits =218 – 138 = 80 credit increase; applied against debt = - 227 credits.
- Water supply: Move 20:20 from San Luis to groundwater
- 4,000 cfs into Bacon for 15 days (full @ 200 KAF
- 2,000 cfs into Webb for 15 days (full @ 100 KAF)
- Water Quality: No actions
- Fish actions: Steelhead show up in the salvage; splittail salvage remains high. Very little left in the way of assets. Remember that state-of-art screens are present, and delta smelt are present in relatively low numbers, so the actual risk to other fish is relatively low. However, the winter run "angst factor" is very high from previous year's escapement of 191. Discussion of borrowing against next year's $30 million to buy more on the spot market. Decision: Use up "anticipated" credits (from valid forecast derived from snowpack) to purchase and exercise SOD credits by 150 KAF to reduce exports. Take the water out of San Luis.

March 93

- Exports = 8,810
- Outflow = 34,731
- (E/I = 20%)
- X2 = 62.3
- Credits = 49 new (additional) credits, bringing the total to -328
- Water supply: Increase exports by 40 KAF into groundwater (20:20) + 80 KAF into San Luis (into the hole created by moving water into groundwater in previous months). Total = 120 KAF.
- EWA: *Could* pump water into San Luis and erase part of the debt by spending only pumping cost (out of the "bank"). Discussion that this might be a "new rule", and could mess up the game. The water exporters' share of San Luis is full, and are willing to pump water, but this leads to a strange imbalance in the credits. Water users would reduce the EWA debt only when San Luis is within the

debt amount from filling (not likely). Much discussion about whether the amount of credits originally given was enough. Should be more credits, or do something about the debt created by pumping reduction in earlier months. Perhaps projects shouldn't be able to pump unless the EWA wants to reduce its debt. But this might not be fair either. Decision: No action.

April 93

- Exports = 8,154
- Outflow = 38,220
- (E/I = 17%)
- X2 = 61.7
- Credits = additional 112, bringing the total to -216
- Water supply: First part of the month the delta is still in surplus. Move pumped water into groundwater (20:20 = 40 KAF). Second half of the month, VAMP kicks in, so take up to 2 kcfs out of Bacon into the hole in San Luis during the last 15 days of the month (20 KAF).
- Fish Actions: Exercise 50 KAF in options on the San Joaquin side for SJR and outflow as a bridge into VAMP (starting one week before VAMP). No export reductions in early April.
- Water Quality: Call half of options (45 KAF).

May 93

- Exports = 5,515
- Outflow = 29,479
- (E/I = 15%
- X2 = 63.6
- Credits increased by 82; brings total to -134
- EWA applies 50 KAF from SOD options to the debt, reducing the debt to -84 KAF
- Let VAMP happen
- Water supply: Take 120 KAF from Bacon to deliveries
- Water Quality: No actions.

June 93

- Exports = 14,900
- Outflow = 16,716
- (E/I = 42%)
- X2 = 68.5
- Credits = 50 new credits + 50 from SOD purchases ; brings total to +16
- Fish actions: Apply 50 KAF of Sacramento options to outflow
- Water quality: No actions

- Water supply: No actions

July 93

- Exports = 5,487
- Outflow = 8,000
- (E/I = 30%)
- X2 = 75.8
- Credits = +16
- EWA: SOD purchase 50 KAF. Put into San Luis as an asset.
- Water Supply: Take 60 KAF to deliveries

NOTES:

- Credits too low; EWA gets into trouble
- Water users are getting too much increase in deliveries.
- Could work with significant adjustments
- Issue of deliveries: Starting off a dry year with storage produces a water user benefit of approximately that amount. In a wet year, there is a significant gain in deliveries. With a couple of dry years in a row, the water supply benefit wouldn't be there (probably).
- The EWA balance of credits at the end of '93 resulted from a lower level of protection, caused in turn by going into debt early.
- Water quality assets are too limited.
- Credit or debit, new assets are important. Very hard to reduce far enough to provide a significant benefit. Need to have major reductions in exports for fish protections. EWA might be structured to have a proportionate share of large pumping events (share of increased pumping). Results of this game made Q-west into a "roller-coaster" (pendulum?).
- Many "swings" in the delta environment, month to month.
- More stability in the gallon-for-gallon approach. This could be solved in part by more credits.
- This is a big leap from the last game...more "control" goes to the exporters.
- Could use a comparative graph of the "export patterns"
- Didn't get the level of protection we wanted; could be the rules or the starting numbers (assets). It takes a lot of assets to knock down the swings. Interesting to have a more active operators role. This game may be more reflective of how operators and fish protectors would work in the real world.
- Couldn't wait to get to VAMP! Maybe it's too easy to have all the VAMP-type actions hard-wired.
- ESA was invoked as a possible role-player

- Maybe too conservative and spent too many resources when the fish being protected were screenable (efficiently).
- There is a worry that the rules will be so tight that in order to generate dynamic credits the game will be too complicated and unwieldy.

GAME 3 - DAY 2

...CONTINUING WITH WATER YEAR 1993

Recap

- Got into a hole earlier in the year, but have come out, but the EWA is almost "broke" except for $9 million and 66 KAF in San Luis

July 93

- Exports = 5,487
- Outflow = 8,000
- (E/I = 30%)
- X2 = 75.8
- Credits = 0
- San Luis EWA = 66 KAF
- Projects: 100 KAF in Webb; 60 KAF in Bacon
- Water Supply: Move 100 KAF out of Webb and 60 KAF out of Bacon to deliveries (both islands now empty).
- So far, 160 KAF increases in deliveries have been realized, plus groundwater and storage.
- There appears to be a problem between the two models, based on discrepancies in deliveries.
- Fish actions: Some smelt and splittail still at the SWP, but we are past the peak. X2 is in good shape (about 75 km). No actions.
- Water quality: Outflow is relatively high; no actions. There was an historical spike in Sacramento River inflow in July, the reason for which is not clear. It might have been some releases from Keswick for winter run temperature reasons.

August 93

- Exports = 13,564
- Outflow = 4,098
- (E/I = 65%)
- X2 = 83.3
- Credits = 0
- San Luis EWA = 66 KAF
- Water Supply: No water left in islands; no actions.

- Fish actions: X2 is moving gradually upstream. San Joaquin flows have dropped. No actions; hold the 66 KAF in San Luis until fall.
- Water Quality: Start moving 45 KAF of Yuba water into San Luis. This could enable some pumping reductions in October to protect water quality.

September 93

- Exports = 11,178
- Outflow = 3,000
- (E/I = 68%)
- X2 = 88.1
- Credits = 0
- San Luis EWA = 66 KAF
- Water supply: No actions.
- Fish actions: Continue releases at Shasta for temperature control mixed with other operational requirements such as flood storage, etc. No other actions.
- Water quality: Continue and complete moving 45 KAF of Yuba water to San Luis for water quality.

WATER YEAR 1994

October 93

- Exports = 14,608
- Outflow = 4,000
- (E/I = 73%)
- X2 = 87.5
- Credits = 260
- San Luis EWA = 66 KAF
- Water supply: No actions.
- Fish actions: Purchase options: 150 KAF South of Delta; 100 KAF SJR; 50 KAF Sacramento
- Water Quality: Purchase 90 KAF in the Yuba basin or the like.

November 93

- Exports = 9,228
- Outflow = 4,502
- (E/I = 63%)
- X2 = 86.4
- Credits = 264 KAF
- San Luis EWA = 66 KAF

- San Luis Water Quality account = 45 – carriage water = 36 KAF
- Water Supply: Move 20:20 to groundwater (Gravelly Ford and Kern)
- Fish Actions: Close CCG. Some large juvenile salmon showing up at the pumps; assume these were detected in RTM.
- *N.B. Closing the CCG might have water quality implications. We will assume closure for this game. There would probably have been a consequent reduction in exports to protect water quality, but this is not assumed for this game. If there would have been a decrease in exports, this would constitute a fish benefit.*

December 93

- Exports = 13,749
- Outflow = 4,602
- (E/I = 71%)
- X2 = 85.9
- Credits = 260
- San Luis EWA = 66 KAF
- San Luis water quality = 0
- Water supply: Pump 40 KAF to San Luis to make up the "hole" created when groundwater was charged last month. Groundwater is now full; no more opportunity.
- *N.B. There is a potential discrepancy in deliveries; the game assumes that deliveries were high, because of higher than "historical" water demand/deliveries. There is some question whether capacity and storage down the system would have been sufficient, and whether demand would really have been there. This means that the EWA could have been "overtaxed" to provide benefits (pumping reductions), which wouldn't have actually been that high. On the other hand, in the reality surplus supply is usually absorbed through "variable demand". Two ways to go: Either the water was delivered, in which case San Luis would be lowered accordingly, or the water was not delivered, in which case it would have been held in the delta islands. Operators are already planning to increase deliveries to blend down the Colorado and to fill Eastside. On the other hand, capacity going in is about 36 KAF/month. San Joaquin rivers were very high earlier in the year, which would probably have ameliorated delta demand in this period. CVP demand is constant. The question remains whether the deliveries and demands are out of sync in this game. They appear to be. Right now, we can't factor in demand/deliveries relationships which would exist in the real world. Suggested that we post-process the demand/deliveries question and assume, for this game, that the deliveries were made. George's model showed very large exports in December, whereas Russ' model shows about 65% of that. George assumed some deliveries to interruptible users. It is possible that the two models are treating groundwater differently, with George's groundwater capacity not yet filled.*
- Fish actions: Some 100 - 200 mm salmon are showing up at the pumps, and there is a desire to protect them. Actions were taken in previous games.
- *N.B. In this case, it seems like the SWP is "max'd out" with both surface and groundwater full. We need to decide to play assuming the deliveries, or to go back and change deliveries and consequent demand on EWA credits to afford protection. The upshot for credits is that if deliveries would not have been so high (Russ' model), there would have been no or less reason to expend credits. If George's model is used, the cost to EWA credits would be very large. This has bogged down the game.*

- *N.B. We could probably take a look at the credit game rules and asset mixes and fix some of the weaknesses and play the game again to see if it would work "mo' betta".*

END OF THIS GAME; NEED TO FIX THE CREDIT APPROACH

Game 4

Game 4 - Day 1/Stage 1

Basic Description: Game 4 represents conditions that would be in place on Day 1 of Stage 1. No new facilities would be available.

Beginning Assets:

- $40 million annual fund for water purchases.
  - 10-year lease options (215TAF)
  - 10-year purchase options (490 TAF)
  - one-year purchase option (750 TAF)
- Ground Water Banks
  - Semitropic (200 TAF of storage space available)
  - Kern (100 TAF of storage space available)
- Expanded Shasta (60 TAF per year if reservoir fills)
- Debt carrying ability in project reservoirs (primarily San Luis and Shasta)

Asset Generating Capability:

- Relaxation of Export/Inflow standards
- Export water to San Luis or groundwater banks when projects were not at capacity.

Baseline Conditions:

- 1995 demand level
- 8500 cfs expanded capacity for Banks pumping plant
- Accord + Upstream AFRP ~~(no In-Delta AFRP)~~ allowed variance
- VAMP experiment continuing

Actions Taken:

- Relaxed E/I standard in dry and wet years to export water into EWA account in San Luis reservoir.
- Limited project exports in winter and spring to reduce fish being drawn to pumping plants.
- Backed up water into Shasta EWA account when possible coincident with export reductions.
- Purchased water in San Joaquin reservoirs for release to rivers and Delta.

Water Operations Summary: Game 4. Year 2000 water year.
May 3, 1999 Draft

Scenario: April			Target Year: End of Stage 1
Possible Water Supply Measures	Details	EWA/ Users Division	How to Model How to Game
South Delta Program - 8.5 kcfs	8.5 kcfs	Projects below E/I. EWA above E/I	Model in baseline. EWA may use in game when available or above E/I.
JPOD. No individual State/ Federal sublimits	No state or federal sublimits apply	Projects below E/I. EWA above E/I	Model in baseline.
Allow E/I variances			EWA may allow pumping above E/I for credit..
Allow in-Delta AFRP variences			EWA may allow pumping above AFRP in-Delta for credit..
Kern Water Bank	200 kaf storage. 20 kaf/ month in. 20 kaf /month out.	EWA	Operate by hand in game. Capacity is high priority -- no preemption by Kern.
Semitropic high priority storage	200 kaf storage 20 kaf/ month in. 10 kaf/ month out.	EWA	Operate by hand in game.
Shasta Dam Expansion	50 kaf storage	Projects	Operate in model
Water purchases	See attached description	EWA	Operate by hand in game
Demand shifting	100 kaf. Short term storage lease in San Luis.	EWA	Operate by hand in game
Access Surplus Capacity		EWA	Operate by hand in game

Water Operations Summary: Game 4. Year 2000 water year.
May 3, 1999 Draft

Initial Conditions

- All storage is empty
- Long-term options begin in the first year of simulation

EWA Budget

$40 million/year, paid on October 1 of each year. Funds may accrue. The EWA may borrow up to $40 million of future income. EWA funds accrue interest at 5% per year. Borrowing costs 5% per year. Capital costs for assumed facilities are outside the game. EWA may build up its fiscal reserves by selling or leasing its rights to water or facilities.

Transfers

Proposal to make water transfer more realistic through following rules:

- 10 year option agreements (with limits on available volume by basin, limits on the number of times the options can be called over 10 years, and costs and volume that vary according to when the option is called).
- Within year water transfers (with limits on available volume by basin, and costs that vary according to when the purchase is made).
- Purchase of surface storage.
- Purchase of stored groundwater (in market)
- Risk factors. Different purchases have varying degrees of risk of delayed approval. Each type of purchase would have given risk anad delay factors. Using a random number generator, we would determine whether or not a transfer would be delayed. If it is delayed, the water could not be moved until the designated time had passed.

Price Schedules

Discretionary and operating costs must be paid for using the EWA budget. These costs include:

Water Operations Summary: Game 4. Year 2000 water year.
May 3, 1999 Draft

- Options -- See Greg Young document
- Spot purchases -- See Greg Young document
- Water sales by EWA -- Price to be negotiated during game.
- Groundwater pumping costs --

  Kern at $100/af
  Semitropic at $200/af

- Demand Shifting

  $100/af to rent up to $100 kaf of storage in San Luis from MWD
  Intention to shift storage must be declared by June 1
  Water must be paid back by January 1 of next year or $1000/af payment

Water Quality Account

Up to $10 million/yr. Account does not accrue.

Modeling Basis

Based upon the matrix above, the modeling upon which the game would be founded would be run with the following assumptions:

- 1995 Level of Development
- Accord + VAMP + all AFRP + Trinity
- South Delta Improvements (8.5 kcfs)
- Unlimited JPOD
- Shasta storage (50 kaf)

Water Supply Evaluation

Water Operations Summary: Game 4. Year 2000 water year.
May 3, 1999 Draft

The results from the modeling basis plus any yield developed because (1) EWA water supplies San Luis lowpoint requirements and (2) by borrowing EWA groundwater storage will roughly represent estimated Project deliveries.

Game Rules

- EWA has the right to carry debt and to use Project facilities, provided it can assure no harm, unless arrangements for compensation are agreed to in advance. Thus, the EWA may borrow against future water supplies, may shift Project storage from upstream storage to downstream storage, etc., provided that it can make the Project's whole before the water is needed.
- EWA must have secure collateral for any borrowing it undertakes within a year. It may carry over debt (if otherwise allowed) without specifically identified collateral.
- Unless otherwise specified, EWA has low priority access to Project facilities.
- Movement of water through the Delta when outflow is controlling has a carriage water cost of 20%. Backing water upstream via export reductions when outflow is controlling reduces carriage water by 20%. Moving water from the San Joaquin tributaries has a cost of 10%.
- Projects may borrow EWA storage within San Luis in order to satisfy low point requirements.
- Projects may borrow EWA groundwater storage on a low priority basis.

Game 4 **Water Year** **1991** Values in italics are calculated

		IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases														
San Joaquin River Market Releases									14					
Delta Cross Channel Closed?														
Change in CCFB/Tracy Diversions			*0*	*0*	*0*	*0*	*0*	*-40*	*50*	*0*	*0*	*0*	*0*	*0*
Carriage Water														
Change in Delta Outflow			*0*	*0*	*0*	*0*	*0*	*40*	*-36*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"														
MWD Shift Water to/from EWA														
Change Groundwater Storage			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage			*0*	*0*	*0*	*0*	*0*	*-40*	*50*	*0*	*0*	*0*	*0*	*0*
Water generated by E/I relaxations			0	0	0	0	0	50	0	0	0	0	0	0
End of Month Values for EWA Accounts			0											
	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA SJR Storage			0	0	0	50	50	100	86	86	86	86	86	86
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	0	0	0	0	0	0	0	0	0	0
EWA San Luis		0	0	0	0	0	0	(40)	10	10	10	10	10	10
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0	0
Upstream Surplus Capture			0	0	0	0	0	0	0	0	0	0	0	0
Delta surplus capture			0	0	0	0	0	0	0	0	0	0	0	0
Purchased														
Year Type: 1 for dry/critical. 0 otherwise			*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River														
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water														
Call spot water														
San Joaquin Tribs														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water						50								
Call spot water														
Export Area														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water								100						
Call spot water														
Cost of Options			*4.8*											
Leasing cost			*15*											
Cost of buying options $millions						3.75		13.5						
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA			*40*											
Interest														
Financial Balance		*0*	*20.2*	*20.2*	*20.2*	*16.45*	*16.45*	*2.95*	*2.95*	*2.95*	*2.95*	*2.95*	*2.95*	*2.95*
Approximate buying power			120.958	120.958	120.958	98.502994	98.503	17.6647	17.6647	17.6647	17.6647	17.6647	17.6647	17.6647
Purchased but undelivered			100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993	1994	1995	
250	325	230	170	300	Purchases
50	0	120	120	0	Relaxed Stds
0	0	0	0	0	Efficiency
0	0	60	0	50	Upstream Surplus Capture
0	0	0	290	0	Delta Surplus Capture

Game 4 **Water** **1992** *Values in italics are calculated*

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases		28.6	28.6	28.6	0	0	60	0	0	0	0		
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*25*	*25*	*25*	*0*	*-60*	*-5*	*50*	*0*	*0*	*0*	*0*	*0*
Carriage Water		3	3	3									
Change in Delta Outflow		*3.6*	*3.6*	*2.6*	*0*	*60*	*65*	*-50*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*25*	*25*	*25*	*0*	*-60*	*-5*	*50*	*0*	*0*	*0*	*0*	*0*
Water generated by E/I relaxations		0	0	0	0	0	0	0	0	0	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA SJR Storage		60	28.6	0	50	50	40	40	40	40	40	40	40
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	0	0	0	0	0	0	0	0	0
EWA San Luis		35	60	86	86	26	21	71	71	71	71	71	71
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Upstream Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Delta surplus capture		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Trib s													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water					50								
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water						100	75						
Call spot water													
Cost of Options		*4.8*											
Leasing cost		*15*											
Cost of buying options $millions					3.75	13.5	13.125						
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.5*											
Financial Balance		*23.6256*	*23.6256*	*23.6256*	*19.8756*	*6.37563*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*
Approximate buying power		141.471	141.471	141.471	119.016	38.1774	-40.4154	-40.4154	-40.4154	-40.4154	-40.4154	-40.4154	-40.4154
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993
250	325	230
50	0	120
0	0	0
0	0	60
0	0	0

Game 4 Water **1993** Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*-60*	*0*	*0*	*0*	*0*	*60*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases		13	13	13								50	
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*12*	*12*	*12*	*-200*	*-120*	*60*	*50*	*0*	*-40*	*0*	*93*	*0*
Carriage Water		1	1	1									
Change in Delta Outflow		*1*	*1*	*1*	*200*	*120*	*-120*	*-50*	*0*	*40*	*0*	*17*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*12*	*12*	*12*	*-200*	*-120*	*60*	*50*	*0*	*-40*	*0*	*93*	*0*
Water generated by E/I relaxations		0	0	60	0	0	60	0	0	0	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	60	60	60	60	60	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA SJR Storage		27	13	0	0	0	50	50	50	50	50	0	0
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	0	0	0	0	0	0	0	0	0
EWA San Luis		83	95	107	(93)	(213)	(153)	(103)	(103)	(143)	(143)	(50)	(50)
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Upstream Surplus Capture		0	0	0	0	0	60	0	0	0	0	0	0
Delta surplus capture		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical, 0 otherwise		*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Trib s													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water						30							
Call spot water						100							
Cost of Options		*4.8*											
Leasing cost		*15*											
Cost of buying options $millions						13							
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.2*											
Financial Balance		*13.6585*	*13.6585*	*13.6585*	*13.6585*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*
Approximate buying power		*81.7872*	*81.7872*	*81.7872*	*81.7872*	*3.94293*	*3.94293*	*3.94293*	*3.94293*	*3.94293*	*3.94293*	*3.94293*	*3.94293*
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993
250	325	230
50	0	120
0	0	0
0	0	60
0	0	0

Game 4 **Water** **1994** *Values in italics are calculated*

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases							60	60					
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*0*	*-200*	*240*	*50*	*-60*	*50*	*120*	*120*	*0*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*0*	*200*	*-240*	*-50*	*120*	*10*	*-120*	*-120*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*20*	*20*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*0*	*-200*	*220*	*30*	*-60*	*50*	*120*	*120*	*0*	*0*	*0*
Water generated by E/I relaxations		0	0	0	0	0	0	0	0	120	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	30	30	30	30	30	30	30
Borrowed EWA SJR Storage		0	0	0	0	0	60	0	0	0	0	0	0
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	20	40	40	40	40	40	40	40	40
EWA San Luis		(50)	(50)	(250)	(30)	0	(60)	(10)	(10)	110	110	110	110
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Upstream Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Delta surplus capture		0	0	0	240	50	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water							70						
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water													
Call spot water													
Cost of Options		*4.8*					*6.75*						
Leasing cost		*15*											
Cost of buying options $millions													
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.2*											
Financial Balance		*21.1081*	*21.1081*	*21.1081*	*21.1081*	*21.1081*	*14.3581*	*14.3581*	*14.3581*	*14.3581*	*14.3581*	*14.3581*	*14.3581*
Approximate buying power		126.396	126.396	126.396	114.42	102.443	62.0243	62.0243	62.0243	62.0243	62.0243	62.0243	62.0243
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993
250	325	230
50	0	120
0	0	0
0	0	60
0	0	0

Game 4 *Water* *1995*

Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*-50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*12*	*-39*	*-240*	*0*	*0*	*50*	*-330*	*-330*	*0*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*-12*	*39*	*190*	*0*	*0*	*-50*	*330*	*330*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*12*	*-39*	*-240*	*0*	*0*	*50*	*-330*	*-330*	*0*	*0*	*0*
Water generated by E/I relaxations		0	0	0	0	0	0	0	0	0	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	50	50	50	50	50	50	50	50	50
Borrowed EWA Sac Storage		30	15	0	0	0	0	0	0	0	0	0	150
Borrowed EWA SJR Storage		0	0	0	0	0	50	50	50	50	50	50	100
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	40	40	40	40	40	40	40	40	40	40	40	40
EWA San Luis		110	122	83	(157)	(157)	(157)	(107)	(107)	(437)	(437)	(437)	(437)
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Upstream Surplus Capture		0	0	0	50	0	0	0	0	0	0	0	0
Delta surplus capture		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													150
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													50
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water													
Call spot water													
Cost of Options		*4.8*											
Leasing cost		*15*											
Cost of buying options $millions													10
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.9*											
Financial Balance		*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*25.4166*
Approximate buying power		188.123	188.123	188.123	188.123	188.123	188.123	188.123	188.123	188.123	188.123	188.123	128.243
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

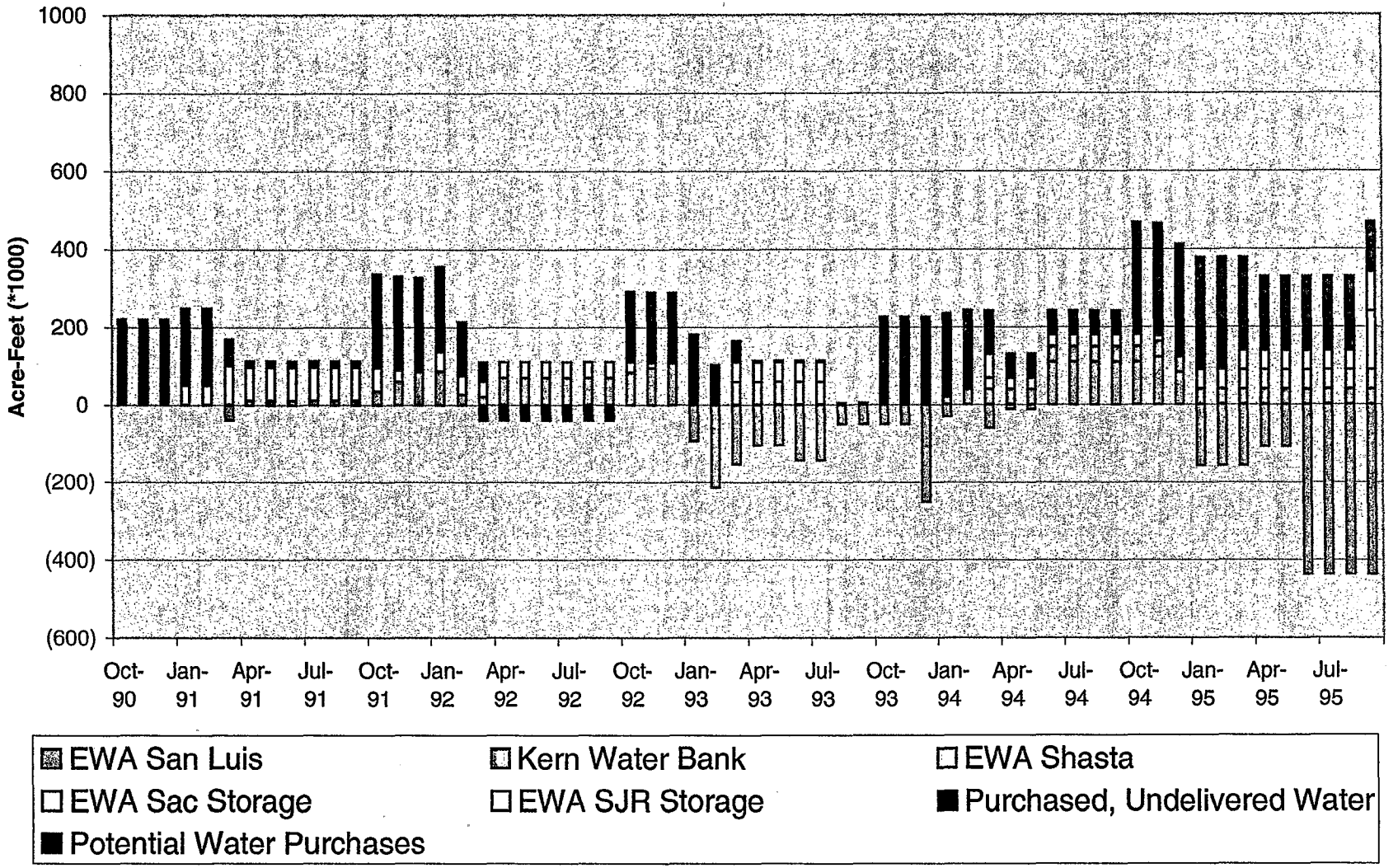
Summary

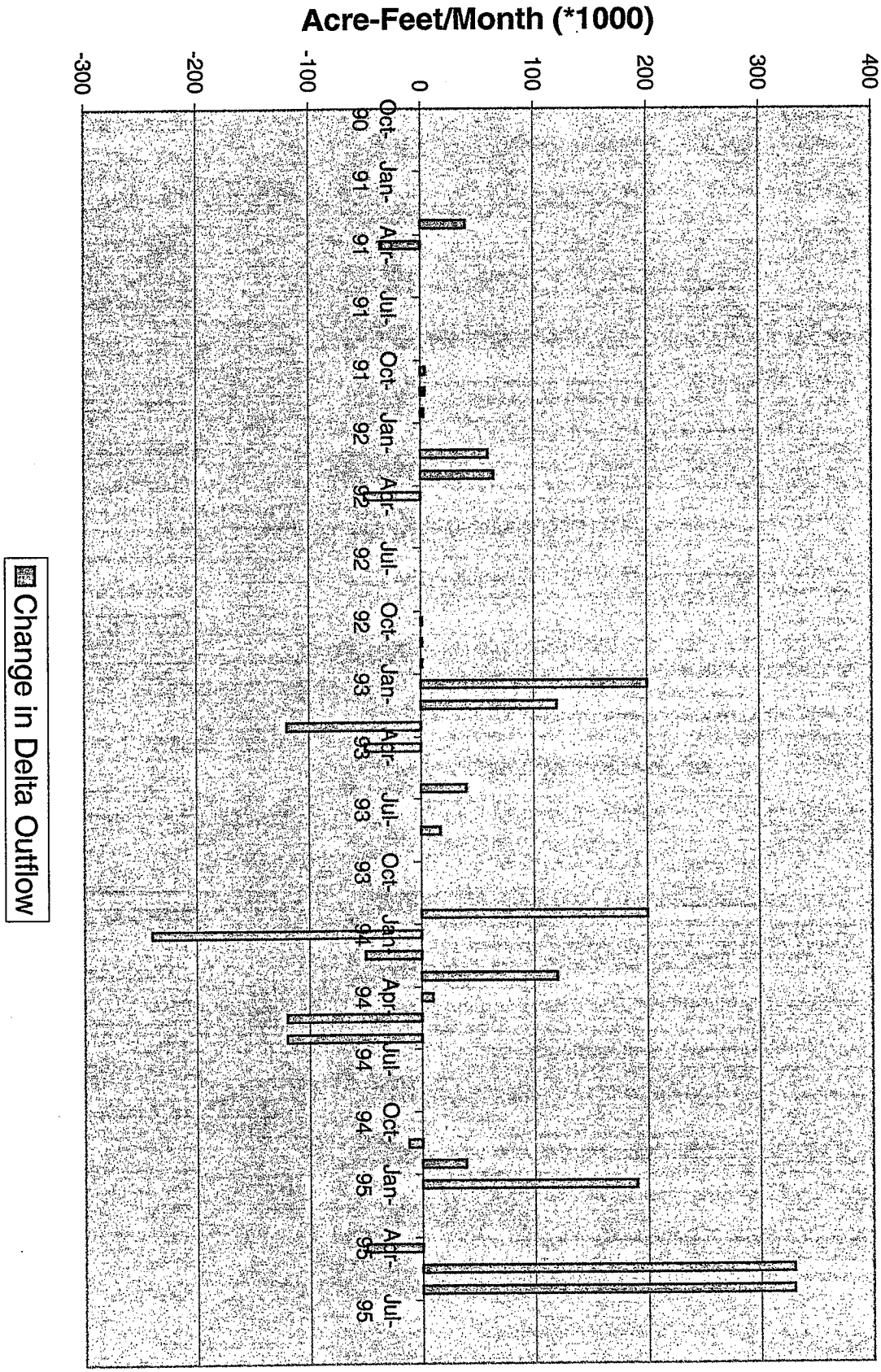
1991	1992	1993
250	325	230
50	0	120
0	0	0
0	0	60
0	0	0

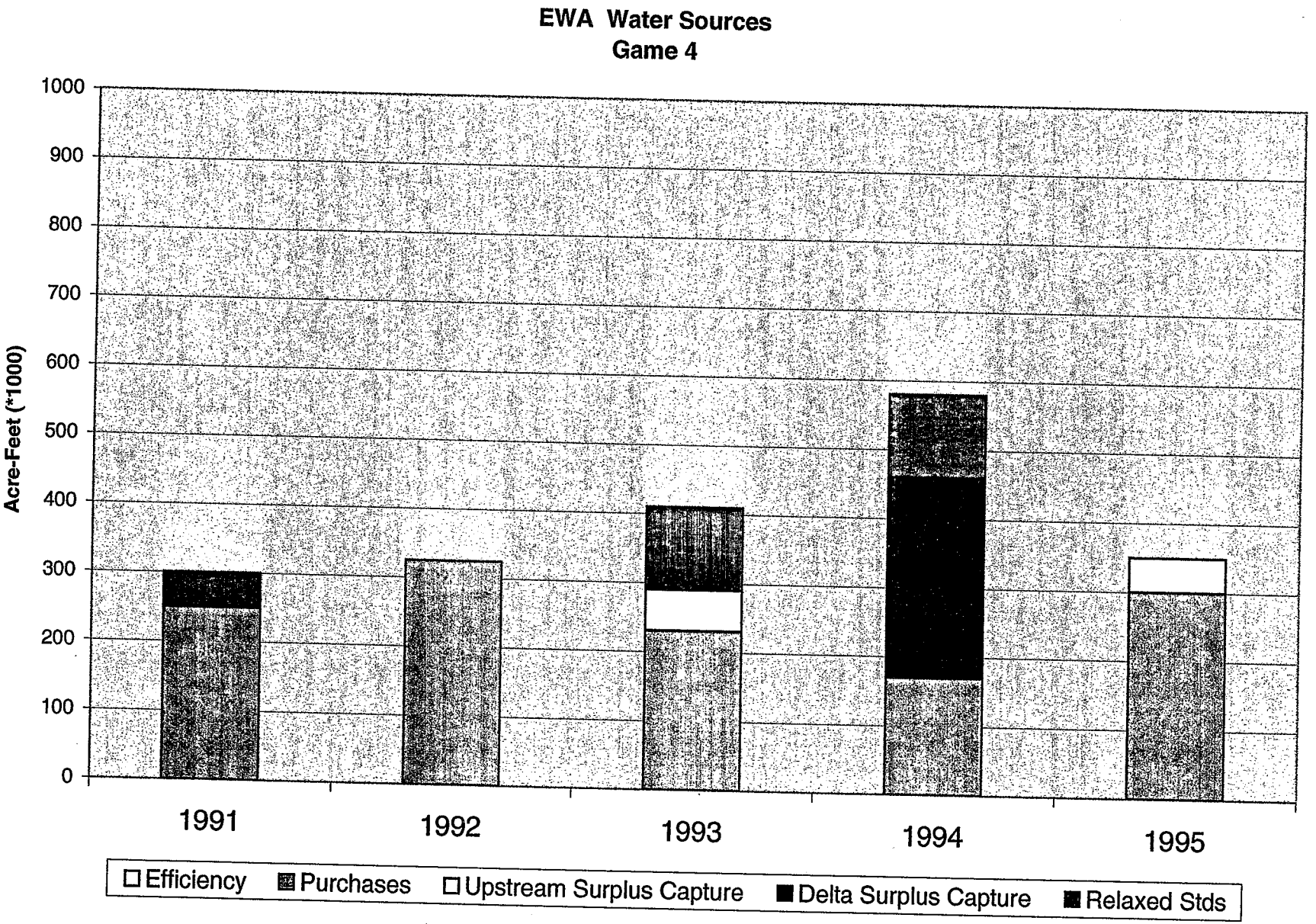
Change In Clifton Court/ Tracy Pumping
March 1999 EWA Game
Acre-Feet/Month (*1000)
300
200
100
0
-100
-200
-300
-400
October-90
October-91
October-92
October-93
October-94

D—0 1 7 2 1 6

EWA Assets
Game 4




Change in Delta Outflow
Acre-Feet/Month (*1000)
400
300
200
100
0
-100
-200
-300
Oct-90
Jan-91
Apr-91
Jul-91
Oct-91
Jan-92
Apr-92
Jul-92
Oct-92
Jan-93
Apr-93
Jul-93
Oct-93
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
Apr-95
Jul-95
Change in Delta Outflow



Game 4	Water Year		1991	Values in italics are calculated									
		IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases														
San Joaquin River Market Releases									14					
Delta Cross Channel Closed?														
Change in CCFB/Tracy Diversions			*0*	*0*	*0*	*0*	*0*	*-40*	*50*	*0*	*0*	*0*	*0*	*0*
Carriage Water														
Change in Delta Outflow			*0*	*0*	*0*	*0*	*0*	*40*	*-36*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"														
MWD Shift Water to/from EWA														
Change Groundwater Storage			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage			*0*	*0*	*0*	*0*	*0*	*-40*	*50*	*0*	*0*	*0*	*0*	*0*
Pumping Above 6680 cfs			0	0	0									
End of Month Values for EWA Accounts			0											
	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA SJR Storage			0	0	0	50	0	100	86	86	86	86	86	86
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	0	0	0	0	0	0	0	0	0	0
EWA San Luis		0	0	0	0	0	0	(40)	10	10	10	10	10	10
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0	0
Increased Deliveries			0	0	0	0	0	0	0	0	0	0	0	0
Purchased														
Year Type: 1 for dry/critical. 0 otherwise			*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River														
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water														
Call spot water														
San Joaquin Tribs														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water						50								
Call spot water														
Export Area														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water								100						
Call spot water														
Cost of Options			*4.8*											
Leasing cost			*15*											
Cost of buying options $millions						3.75		13.5						
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA			*40*											
Interest														
Financial Balance		*0*	*20.2*	*20.2*	*20.2*	*16.45*	*16.45*	*2.95*	*2.95*	*2.95*	*2.95*	*2.95*	*2.95*	*2.95*

Game 4	Water	1992				Values in italics are calculated							
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases		28.6	28.6	28.6	0	0	60	0	0	0	0		
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*25*	*25*	*26*	*0*	*-60*	*-5*	*50*	*0*	*0*	*0*	*0*	*0*
Carriage Water		3	3	3									
Change in Delta Outflow		*3.6*	*3.6*	*2.6*	*0*	*60*	*65*	*-50*	*0*	*0*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*25*	*25*	*26*	*0*	*-60*	*-5*	*50*	*0*	*0*	*0*	*0*	*0*
Pumping Above 6680 cfs													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA SJR Storage		60	28.6	0	50	50	40	40	40	40	40	40	40
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	0	0	0	0	0	0	0	0	0
EWA San Luis		35	60	86	86	26	21	71	71	71	71	71	71
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Increased Deliveries		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water						100							
Call spot water													
Cost of Options		*4.8*											
Leasing cost		*15*											
Cost of buying options $millions					3.75	13.5	13.125						
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.5*											
Financial Balance		*23.6256*	*23.6256*	*23.6256*	*19.8756*	*6.37563*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*	*-6.74938*

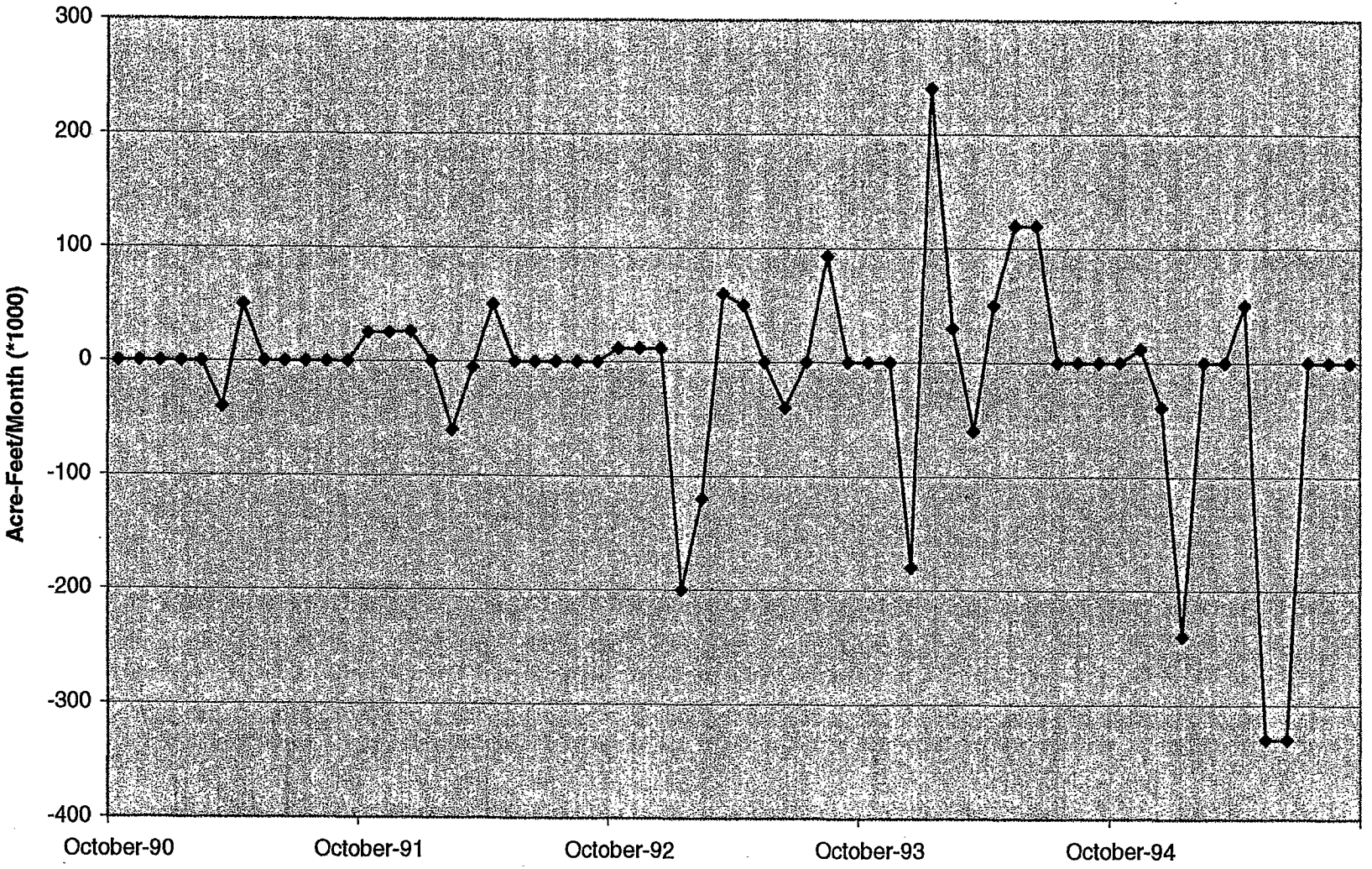
Game 4	Water	1993	Values in italics are calculated										
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*-60*	*0*	*0*	*0*	*0*	*60*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases		13	13	13									
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*12*	*12*	*12*	*-200*	*-120*	*60*	*50*	*0*	*-40*	*0*	*93*	*0*
Carriage Water		1	1	1									
Change in Delta Outflow		*1*	*1*	*1*	*200*	*120*	*-120*	*-50*	*0*	*40*	*0*	*-33*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*12*	*12*	*12*	*-200*	*-120*	*60*	*50*	*0*	*-40*	*0*	*93*	*0*
Pumping Above 6680 cfs													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	60	60	60	60	60	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA SJR Storage		27	13	0	0	0	50	50	50	50	50	0	0
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	0	0	0	0	0	0	0	0	0
EWA San Luis		83	95	107	(93)	(213)	(153)	(103)	(103)	(143)	(143)	(50)	(50)
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Increased Deliveries		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water						30							
Call spot water						100							
Cost of Options		*4.8*											
Leasing cost		*15*											
Cost of buying options $millions						13							
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.2*											
Financial Balance		*13.6585*	*13.6585*	*13.6585*	*13.6585*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*	*0.65847*

Game 4 Water 1994 *Values in italics are calculated*

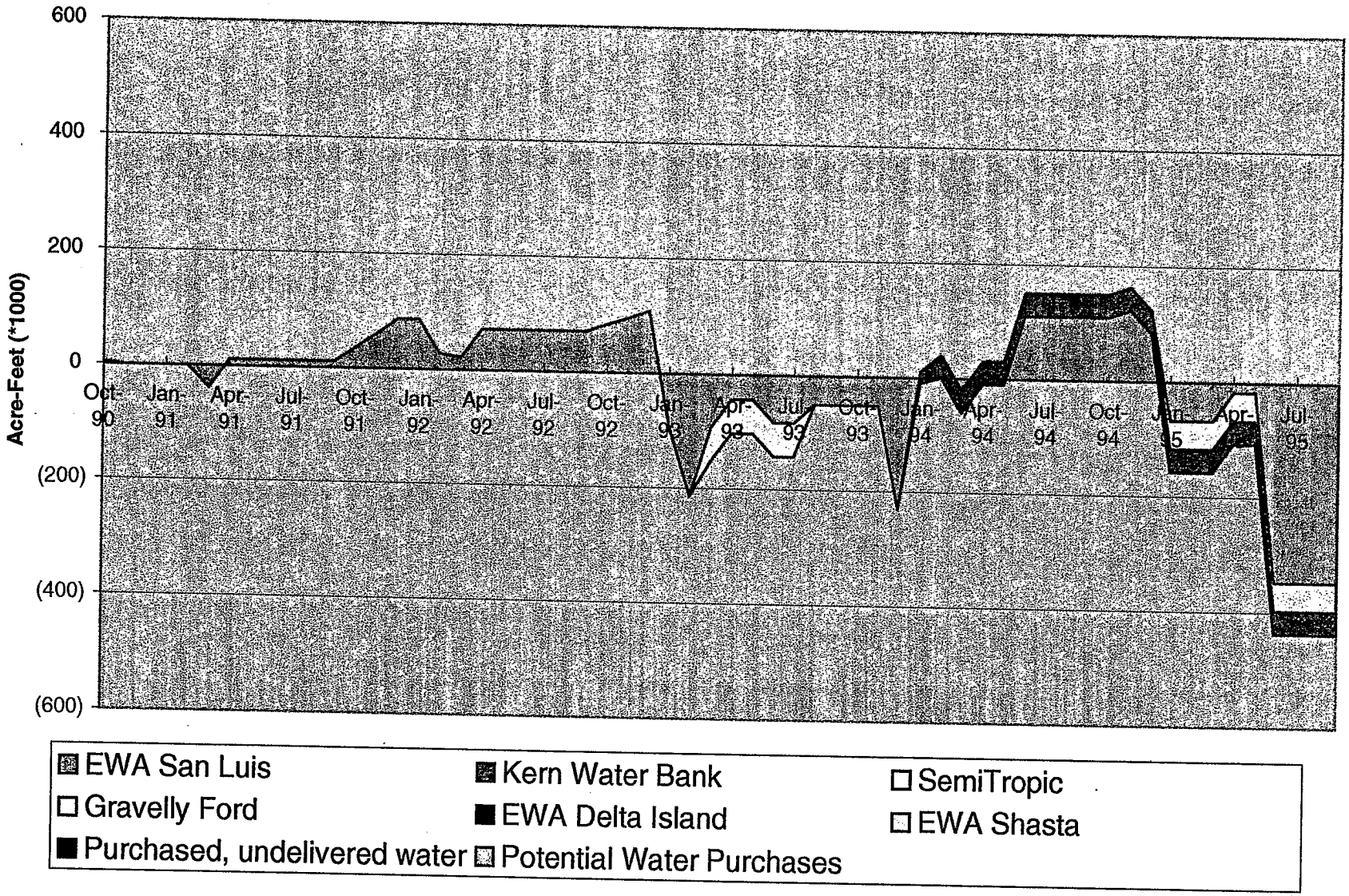
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases							60	60					
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*0*	*-180*	*240*	*30*	*-60*	*50*	*120*	*120*	*0*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*0*	*-180*	*-240*	*-30*	*120*	*10*	*-120*	*-120*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*20*	*20*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*0*	*-180*	*220*	*10*	*-60*	*50*	*120*	*120*	*0*	*0*	*0*
Pumping Above 6680 cfs													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	0	0	0	0	0	0	0	0	0
Borrowed EWA Sac Storage		0	0	0	0	0	30	30	30	30	30	30	30
Borrowed EWA SJR Storage		0	0	0	0	0	60	0	0	0	0	0	0
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	0	0	0	20	40	40	40	40	40	40	40	40
EWA San Luis		(50)	(50)	(230)	(10)	0	(60)	(10)	(10)	110	110	110	110
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Increased Deliveries		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water							70						
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water													
Call spot water													
Cost of Options		*4.8*					*6.75*						
Leasing cost		*15*											
Cost of buying options $millions													
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.2*											
Financial Balance		*21.1081*	*21.1081*	*21.1081*	*21.1081*	*21.1081*	*14.3581*	*14.3581*	*14.3581*	*14.3581*	*14.3581*	*14.3581*	*14.3581*

Game 4	Water	1995	Values in italics are calculated										
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*-50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*12*	*-39*	*-240*	*0*	*0*	*50*	*-330*	*-330*	*0*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*-12*	*39*	*190*	*0*	*0*	*-50*	*330*	*330*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*12*	*-39*	*-240*	*0*	*0*	*50*	*-330*	*-330*	*0*	*0*	*0*
Pumping Above 6680 cfs													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta Water		0	0	0	50	50	50	50	50	50	50	50	50
Borrowed EWA Sac Storage		30	15	0	0	0	0	0	0	0	0	0	0
Borrowed EWA SJR Storage		0	0	0	0	0	0	0	0	0	0	0	0
SemiTropic	200	0	0	0	0	0	0	0	0	0	0	0	0
Kern	100	40	40	40	40	40	40	40	40	40	40	40	40
EWA San Luis		110	122	83	(157)	(157)	(157)	(107)	(107)	(437)	(437)	(437)	(437)
Borrowed MWD		0	0	0	0	0	0	0	0	0	0	0	0
Project Debt to EWA in SLR		0	0	0	0	0	0	0	0	0	0	0	0
Increased Deliveries		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*	*120*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water													
Call spot water													
Cost of Options		*4.8*											
Leasing cost		*15*											
Cost of buying options $millions													
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*40*											
Interest		*0.9*											
Financial Balance		*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*	*35.4166*

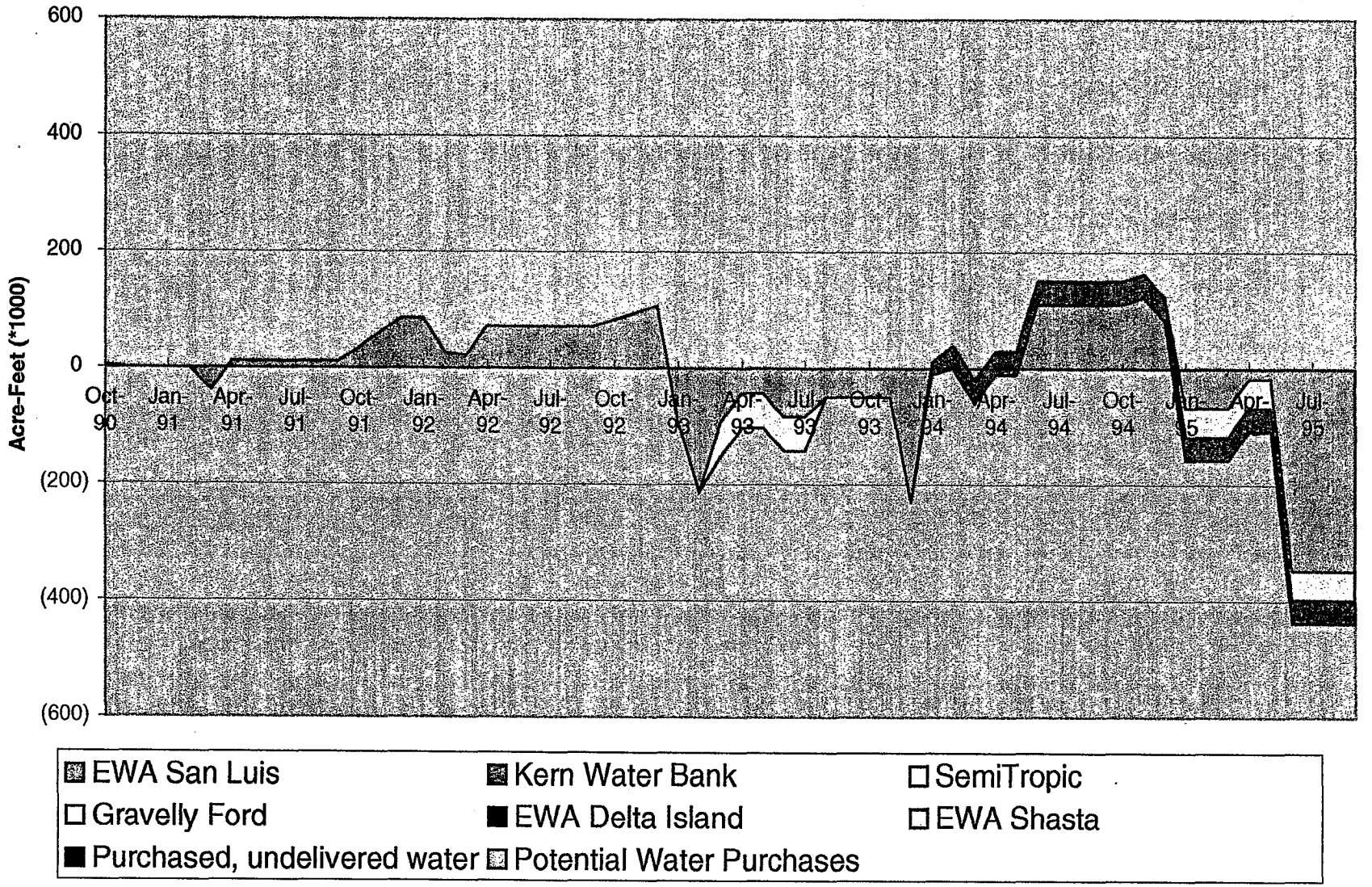
Change In Clifton Court/ Tracy Pumping
March 1999 EWA Game



EWA Assets


600
400
200
0
(200)
(400)
(600)
Acre-Feet (*1000)
Oct-90
Jan-91
Apr-91
Jul-91
Oct-91
Jan-92
Apr-92
Jul-92
Oct-92
Jan-93
Apr-93
Jul-93
Oct-93
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
Apr-95
Jul-95
EWA San Luis
Kern Water Bank
SemiTropic
Gravelly Ford
EWA Delta Island
EWA Shasta
Purchased, undelivered water
Potential Water Purchases

EWA Assets



Change in Delta Outflow

D—0 1 7 2 2 8

Game 4: 1991

- No Delta Storage
- Have Ground Water
- Extra Money 40 M
- Less ability to put water in SOD
- More options for water purchase
- Similar objectives as early games
- Focus on SJ water purchases – many advantages over Sacramento water
- Groundwater: Kern is almost full; leasing or borrowing for Kern is also possible; out is only 10 TAF- 30 TAF in. Unknown cost for buying Kern capacity. Semi-tropic: small premium from Santa Clara because they are not using capacity.
- With AFRP in there is not much to gain with 8500 expanded Banks.
- Model already assumes some water from Kern for project purposes.
- Consider 2-ft additional flash boards on Shasta for EWA. (60 TAF)
- Baseline is only +25 TAF of WS above the Accord – short of (200-400TAF) goals for WS.
- Focus on June – Sept for big pumps. March early April share when in surplus.
- Will keep track of WS pumping above 6680 cfs, and think of sharing in next game.
- Water purchases are less available than we have assumed.

October	Exports 3175, outflow 5447, E/I 31%, X2 86 SJ pulse not covered. No actions.
November	Exports 4936/4951, outflow 3500/3500, E/I 52/52 X2 88 No actions.
December	
January	Exports 3902, outflow 4732, E/I 44%, X2 86 No Actions.
February	Export 975, outflow 11970, E/I 7%, X2 78.5 Outflow limiting. No actions. Water available for EWA was foregone due to delta smelt presence.
March	Exports 11,075, ouflow 25 kcfs, E/I 32%, X2 70. Delta smelt are concentrated at 89. Relax E/I first week, second week nc, limit exports to 5kcfs in last two weeks. Cost of 140 matched by 100 purchase export area.
April	Exports 4000, outflow 14000, E/I 20%, X2 72. Because SJ is over 1000 cfs we can use expanded Banks above 6680 cfs. But only 2TAF. Released 1000 cfs from SJ in first week 14 TAF. Begin Vamp a week early because chinook showed up. Water supply impact of 125 TAF but not EWA cost, but may make up in May.
May	Export 2160, outflow 7000., E/I 19%, X2 88 No action. Biol may store SJ water in SL which would have WQ and WQ benefits.

June	Export 215, outflow 6000, E/I 2 %, X2 81.
July	Export 122, outflow 4,000 , E/I 1%, X2 85
August	
September	
Yearly totals	

Game 4: 1992

- No Delta Storage
- Have Ground Water
- Extra Money 40 M
- Less ability to put water in SOD
- More options for water purchase
- Similar objectives as early games
- Focus on SJ water purchases – many advantages over Sacramento water
- Groundwater: Kern is almost full; leasing or borrowing for Kern is also possible; out is only 10 TAF- 30 TAF in. Unknown cost for buying Kern capacity. Semi-tropic: small premium from Santa Clara because they are not using capacity.
- With AFRP in there is not much to gain with 8500 expanded Banks.
- Model already assumes some water from Kern for project purposes.
- Consider 2-ft additional flash boards on Shasta for EWA. (60 TAF)
- Baseline is only +25 TAF of WS above the Accord – short of (200-400TAF) goals for WS.
- Focus on June – Sept for big pumps. March early April share when in surplus.
- Will keep track of WS pumping above 6680 cfs, and think of sharing in next game.
- Water purchases are less available than we have assumed.

October	Exports 3, 4, 4 kcfs Outflow 5500, 3500, 3500 E/I 31, 46, 48 % X2 86, 88, 88 Release 28.6 TAF from SJ in each month and pick up in San Luis for EWA SOD storage. In December we had to relax E/I to move SJ water to SanLuis.
November	
December	
January	Exports 8500, outflow 4700, E/I 64%, X2 86. The impact on deliveries from moving VAMP may be erased by filling SL this month.
February	Exports 8200, outflow 31,000, E/I 22%, X2 71 Relax E/I in EWA to S in first week, restrict exports to 5 kcfs cost or 160TAF. Buy 3.75 million SJ water.
March	Export 8227, outflow 15,154, E/I 35%, X2 72 Augment SJ by 1000 and cut exports by 1000 cfs. Released 60 TAF on SJ.
April	Exports 2904, outflow 10567, E/I 19, X2 75 VAMP started April 1. Bought 75 TAF from export area.
May	Exports 484, outflow 7300, E/I 4%, X2 78.5 Cost of 120 TAF to WS from moving VAMP, no cost to EWA.
June	No actions.
July	

August	
September	
Yearly totals	

Game 4: 1993

- No Delta Storage
- Have Ground Water
- Extra Money 40 M
- Less ability to put water in SOD
- More options for water purchase
- Similar objectives as early games
- Focus on SJ water purchases – many advantages over Sacramento water
- Groundwater: Kern is almost full; leasing or borrowing for Kern is also possible; out is only 10 TAF- 30 TAF in. Unknown cost for buying Kern capacity. Semi-tropic: small premium from Santa Clara because they are not using capacity.
- With AFRP in there is not much to gain with 8500 expanded Banks.
- Model already assumes some water from Kern for project purposes.
- Consider 2-ft additional flash boards on Shasta for EWA. (60 TAF)
- Baseline is only +25 TAF of WS above the Accord – short of (200-400TAF) goals for WS.
- Focus on June – Sept for big pumps. March early April share when in surplus.
- Will keep track of WS pumping above 6680 cfs, and think of sharing in next game.
- Water purchases are less available than we have assumed.

October **November** **December**	Exports 3600/4400/11100 Outflow 5463/3500/6100 E/I 35/49/65 X2 86/88/84 Move 13 Taf in each month from SJ to SL. Available water in November and December for pumping to EWA, but decided no in November; but yes in early December pulse (60TAF). Cut exports in late December.
January	Exports 12700, outflow 57000, E/I 20%, X266 Splittail trigger of 25 and cutting exports by 50%. 240 TAF cost to EWA, not calling options yet, because spot market may be cheaper than options.
February	Exports 12300, outflow 50000, E/I 21, X2 61. Splittail trigger of 25. Steelhead trigger of 10. Total cost of 250 TAF, purchased 100 TAF of exports.
March	Exports 12300, outflow 29000, E/I = 30%, X2 63 Will show a salmon hit in March. Relax E/I for month to get water back in latter half of month. Gained 60 TAF. Gained 60 TAF in Shasta as it spilled.
April	Exports 6500, outflow 39000, E/I 13 %, X2 62 Historic deliveries were 4 maf, model 95 is 6 maf, so SL is way below historic levels and Shasta is full.

May	*Exports 4600/12400, Outflow 30400/ 19200, E/I 12/35, X2 63/67* Concern about higher pumping in June after VAMP with less of program on line to protect fish. Concern that April May actions such as VAMP did not move smelt from Delta where they are vulnerable to pumps. Would densities in June remain high or be lower? Ramp up exports beginning in mid May til mid June. Cost of 30 TAF but gained back 30 in late June.
June	
July	Exports 13/9/10; Outflow 8, 4, 3 E/I 51, 56, 65 X2 75, 83, 87 Move water from upstream to San Luis.
August	
September	
Yearly totals	

Game 4: 1994

- No Delta Storage
- Have Ground Water
- Extra Money 40 M
- Less ability to put water in SOD
- 1500 export limits during all of May for VAMP.
- VAMP target is 3200 cfs at Vernalis.
- More options for water purchase
- Similar objectives as early games
- Focus on SJ water purchases – many advantages over Sacramento water
- Groundwater: Kern is almost full; leasing or borrowing for Kern is also possible; out is only 10 TAF- 30 TAF in. Unknown cost for buying Kern capacity. Semi-tropic: small premium from Santa Clara because they are not using capacity.
- With AFRP in there is not much to gain with 8500 expanded Banks.
- Model already assumes some water from Kern for project purposes.
- Consider 2-ft additional flash boards on Shasta for EWA. (60 TAF)
- Baseline is only +25 TAF of WS above the Accord – short of (200-400TAF) goals for WS.
- Focus on June – Sept for big pumps. March early April share when in surplus.
- Will keep track of WS pumping above 6680 cfs, and think of sharing in next game.
- Water purchases are less available than we have assumed.

October	October – No action. November - Starting in second week of November close DCC gates. December - constrain exports to 7000 cfs through December based on the presence of spring run yearling salmon and other salmon of similar size. Cost of 180 TAF
November	
December	
January	Exports 13354, outflow 7870, E/I .60, X2 80.5 No Action. Moved 20 of SL into Kern – taking additional 20 TAF of debt in SL. 250 TAF debt is relaxed to 30 because we are within 30 TAF of filling SL.
February	Exports 6650, outflow 25000, E/I 21%, X2 71 Put 20 TAF into Kern – no cost because SL is full. All debt erased. No actions for fish.
March	Exports 5500, outflow 11100, E/I 31%, X2 74. More winter run in samples indicate protection is needed despite low numbers in salvage. Purchased 70 TAF from 10yr SJ market. Set exports to 4000 cfs. Released 60 TAF from SJ reservoirs. Backed up 30 TAF into Folsom.
April	No actions. Vamp protecting. 60TAF or 2000 cfs augmentation in first

	two weeks from SJ.
May	Export 2, outflow 8, E/I 17, X2 79. May no action.
June	Relaxed E/I to gain 120 TAF in San Luis. No fish action
July	Exports 5873/11800/7930 Outflow 4, 3, 2k E/I 40/65/65 X2 85/89/90
August	
September	No actions.
Yearly totals	

Game 4: 1995

- No Delta Storage
- Have Ground Water
- Extra Money 40 M
- Less ability to put water in SOD
- 1500 export limits during all of May for VAMP.
- VAMP target is 3200 cfs at Vernalis.
- More options for water purchase
- Similar objectives as early games
- Focus on SJ water purchases - many advantages over Sacramento water
- Groundwater: Kern is almost full; leasing or borrowing for Kern is also possible; out is only 10 TAF- 30 TAF in. Unknown cost for buying Kern capacity. Semi-tropic: small premium from Santa Clara because they are not using capacity.
- With AFRP in there is not much to gain with 8500 expanded Banks.
- Model already assumes some water from Kern for project purposes.
- Consider 2-ft additional flash boards on Shasta for EWA. (60 TAF)
- Baseline is only +25 TAF of WS above the Accord - short of (200-400TAF) goals for WS.
- Focus on June - Sept for big pumps. March early April share when in surplus.
- Will keep track of WS pumping above 6680 cfs, and think of sharing in next game.
- Water purchases are less available than we have assumed.

October	Exports 5, 6, 10 "Release Folsom water of 250 cfs for Nov and Dec. Relaxed E/I in first week of Dec. Constrain exports to 8kcfs in last two weeks of Dec.
November	
December	
January	Constrain exports to 8000 cfs all month. Cost of 240 TAF. Cost of 250 cfs in first two weeks of month to keep American River flows at Nov-Dec level. Debt held in Folsom.
February	No Action.
March	No Action.
April	No Action.
May	VAMP all month
June	Vamp carried extra week in June with 3kcfs, 4.5 second week, 6 third week..

July	*No Actions.*
August	
September	
Yearly totals	

GAME 4 - BIOLOGICAL

"Day One, Stage I"

October 90 - Water Year 1991

- This game may be significantly different, given new assumptions and starting points. The EWA has fewer tools...no delta storage and no part-full storage. More money, however ($40 million). Back to 6,600 cfs at the pumps. Fewer opportunities to move EWA water into storage. More realistic water leasing and options scenarios. EWA should "automatically" exercise all options on the SJR side, and eschew the Sacramento side. This would be 10-year leases, 10-year options and 1-year options. SJR water is generally more versatile, and there is almost always a desire to augment SJR flows. There is always an option to back up SJR water into Shasta to gain benefits on the Sacramento side. The purchase of these options would mean $6.6 million and another 30 million or more to actually purchase the options. SJR options also allow taking advantage of the new Corps criteria for pumping a third of the SJR flow over a Q of 1,000 cfs.
- This game may be more realistic, given where the facilities are at this point in time. There is presently some question about the biological goals. Water supply and quality are also goals, but the quantitative aspects are a bit uncertain.
- We will need to move quickly through this game.
- For groundwater, the Kern bank may be presently at maximum in-out (10 out; 30 in); there may be a need to "rent" the space or pay for use of the Kern bank. Perhaps we should just change the in-out parameters; there is a capability to rent space in Semi-Tropic, but it may be more expensive to rent space in Kern. Probably should change the "out" to 10 and the "in" to 20, recognizing some competition for putting water in.
- With AFRP in place, there isn't much advantage to the increased pumping capacity; probably should not share the expanded pumping capacity at Banks.
- New study: No. 847. See handout for assumptions. New Banks capacity and a smaller water bank. New pumping rates for Nov. thru Apr. of 6680 cfs + 1/3 of SJR when Q>1,000, up to 8500 in June - September and 6680 in October and May. Other details in handout.
- Shasta raising: Could possibly be done with an EA, with no permanent structures or storage. Biggest opposition from CalSpa and local land owners. Could have implications for further expansion to even bigger (permanent) storage capacity. Temporary increases would be use of the existing 2-ft flashboards = about 60 KAF storage.
- Soon we need to see how EWA assets can build with a sharing of facilities and resources. This is very complex to model, but we could identify opportunities as we go through.
- Water supply yield, using the latest base study, there is still a very significant shortfall of water supply needs. Probably can't do sharing of facilities and assets in this game, if we want to be realistic and reflect all stakeholder needs. Still, we have discussed sharing, and we need to take this concept into account at some time. The question is whether we should share facilities in *this* game. Perhaps the best time to do this is in Game 5, when in-delta AFRP is not included. Perhaps there is a middle road to share facilities under certain circumstances, when the delta is in excess. Under these conditions, sharing could be 50/50.
- Proposal: No sharing in the summer (June thru September), and other seasons share the excess pumping capacity 50/50 when the delta is in surplus. Same sharing of the increase in Shasta

storage. There is some "discomfort" on the part of water users with this proposal, for supply reasons. (We may be getting too clever here.)

- There is some imbalance in consideration of all groundwater resources (assets) going to EWA.
- Another way to go is to identify (flag) times when sharing *would have* been implemented (when delta is in surplus and excess capacity is available) and to keep a separate account to represent gains/expenditures that would have accrued to EWA. **Decision:** Play the game without sharing as part of the modeling, but keep a tally of opportunities, gains and costs.
- Assumption: Purchase each year, 0 on the Sacramento side, 50 KAF on the San Joaquin side, 50 KAF south of delta; lease options, 0 on the Sacramento side, 120 KAF on the SJR side and 120 SOD. Lease cost = $15 million; options cost = $6.6 million. [Revise costs !!]
- Objective for biology: Try to solve the problems we tried to solve in Game 1 with the new mix of assets, and compare outputs. For this reason, we will gloss over an October pulse need in the San Joaquin, which was glossed over in the first game.
- Exports = 3,175
- Outflow = 5,447
- E/I = 31%
- X2 = 85.7
- Assume extra Shasta storage starts empty.
- Fish status: Striped bass present. No other fish problems.
- No fish actions.
- EWA actions: Just the assumed purchases of water and options.
- Water supply actions: None
- Water quality actions: None

November / December 90

- Exports = 4,936 / 4,951
- Outflow = 3,500 / 3,500
- E/I = 52% / 52%
- X2 = 87.8 / 88.4
- No fish, EWA, water supply or quality actions.

January 91

- Exports = 3,902
- Outflow = 4,732
- E/I = 44%
- X2 = 86.3

- Fish status: OK
- Fish actions: None
- EWA actions: Call in 50 KAF of options on the San Joaquin side to boost SJR flows later on.
- Water supply / quality: None

February 91

- Exports = 975
- Outflow = 11,970
- E/I = 7%
- X2 = 78.5
- Fish status: OK
- Fish actions: None
- Water supply / quality: None
- EWA actions: Potential need to exercise options in consideration of fallowing schedules. EWA could also relax E/I and take about 50 KAF out of a "real" storm pulse. Chlorides are low and dropping fast. Decision: Concerns over moving X2 upstream, so don't pump the storm.
- Keswick releases have been increased to meet X2 requirements, putting Shasta storage in a bad way.
- N.B. There is a discrepancy in the two models with respect to X2.

March 91

- Exports = 11,675
- Outflow = 25,040
- E/I = 32%
- X2 = 70.3
- Banks pumping = 7,450
- Big inflow occurred in March ("Miracle March")
- EWA: Could pick up SJR water according to a couple of scenarios.
- Fish status: Salmon are at low densities for the first 2 weeks, but if exports are increased, absolute salvage would go up accordingly. SWP salvage of chinook is beginning to rise. Delta smelt salvage has declined from low levels in January and February. Center of distribution is at about 89 km (near the confluence).
- Fish actions: Could relax E/I and pump EWA water in the early part of the month (first week only; let the second week go by) and reduce in the latter part of the month, following the inverse of chinook occurrence. Decision: do it. Reduce combined exports in the second two weeks to 5 KAF. EWA cost = 140 KAF. Saved 3,000 chinook, 4,000 steelhead and 1,000 splittail. (This implies that EWA should have been calling in more SOD options.)

- EWA actions: Call in 100 KAF of SOD options to cover pump reduction needs. Cost = $13.5 million.

April 91

- Exports = 4,044
- Outflow = 14,028
- E/I = 20%
- X2 = 72
- Fish status: The large salmon are gone, but fall chinook smolts are starting to show up. Delta smelt: no problems.
- EWA out of money, but can borrow up to $40 million. SJR side has 100 KAF in assets in place.
- Fish actions: Could ramp SJR flows up by 1,000 cfs in the first 2 weeks and pump 1/3 of the SJR flow into San Luis (need to consider conveyance losses). This is to "fill in" the SJR prior to VAMP. Two of the 28 KAF "spent" could be recovered to the EWA, unless the E/I is relaxed...even then, not much would be recovered. Could start VAMP early, but would have to end it early. San Luis might have a low point problem. Need to pay off the EWA water debt. Could go further into debt, but this is environmentally risky. If EWA would start VAMP in the second week of April (one week early). This will avoid so much debt in the first part of the month, in consideration of the rapidly increasing density of fall run smolts in the salvage, but has some associated risk that there will be some debt later associated with continued fish presence. The impact to water supply would be 120 KAF; *this is not an EWA cost.* Would save 4,000 chinook, 500 steelhead, 6,000 splittail and 100 delta smelt. Could make a cut in exports in the early part of the month, and use San Luis assets to pay this back. In reality, EWA might take more salvage losses before taking aggressive action. Decision: Let exports alone for the first week and start VAMP one week early. Still add 1,000 cfs of EWA water to SJR flow in the first week, but not in the second week.
- Some discrepancy between the two models with regard to inflow: George's model shows about 6,500 cfs more than historical, with reservoirs nearly empty. This release could have been saved and would have reduced the water supply "hit". No readily apparent reason for this.

May 91

- Exports = 2,160
- Outflow = 7,024
- E/I = 19%
- X2 = 77.9
- Fish status: Delta smelt – OK; center of population indeterminate. Salmon present in significant numbers in the beginning of the month, declining during the end of the month. VAMP ends the end of the third week of May. Pumping is only at about 2,000 cfs in the end of the month because of outflow limits. Striped bass present.
- Fish actions: Could add to SJR flows (and recapture, less 10%). Also could borrow or rent storage. Decision: No fish or EWA action.
- EWA has 86 KAF remaining on the San Joaquin. Can use this water and recapture all but 10% conveyance loss *if* there is no overriding reason to let this water go to outflow. Decision: No action.

June 91

- Exports = 215
- Outflow = 5,981
- E/I = 2%
- X2 = 81.1
- Fish status: Splittail and delta smelt are present in large numbers, especially splittail. Delta smelt might have been pushed a bit further downstream due to previous actions, but X2 doesn't show much difference, so the effect would probably have been small.
- EWA action: Could move the SJR water now and recapture it to San Luis *or* do this later when there are fewer fish present. Storage is plentiful. There also may be enough concern over the low point in San Luis, that a deal could get cut to store some EWA there as the result of a trade. Release of SJR water would not have much value as instream flow at this time (or in July). Exports are at such a low level, releasing to outflow wouldn't accomplish much. Could retain in storage as EWA caryover, or could release this water in the fall for instream flow benefits. There is some storage availability on the Sacramento, but releases are already at a critically low level. Decision: Leave the water where it is, for now.
- Water supply: EWA has several uses of water, including storing in San Luis which would have both supply and quality benefits for water users, but there is no tool presently in place to accomplish a "deal" with the water users.
- Exports are so low that, in spite of significant densities, actual impacts on fish are very small.

July 91

- Exports = 122
- Outflow = 4,000
- E/I = 1%
- X2 = 85.2
- Fish status: Lots of striped bass; splittail densities are high for first week; delta smelt densities are high.
- Fish actions: None
- Water supply / quality actions: None.

August / September 91

- Exports = 2,689 / 4,961
- Outflow = 3,000 / 3,000
- E/I = 31% / 49%
- X2 = 88.9 / 89.9
- Fish status: Splittail densities at zero. Delta smelt densities high.

- **Fish savings for the year over historic levels (not model base):** Big savings of steelhead and splittail; no significant delta smelt, chinook or striped bass savings.

October/November/December (1991; 1992 water year)

- Exports = 3,000 / 3,950 / 4,250
- Outflow = 3=5,500 / 3,500 / 3,500
- E/I = 31% / 46% / 48%
- X2 = 85.
- EWA actions: Release 86 KAF starting 01 October through 31 Dec at 500 cfs to stimulate SJR flows for spawning and other instream flow benefits.
- Fish status: No problems through end of December; no fish actions.
- EWA actions: 25 KAF in each of October, November, December to San Luis.

January 92

- Exports = 8,472
- Outflow = 4,699
- E/I = 64%
- X2 = 86.4
- Fish status: Salmon stocks are very depressed (low escapements), elevating the "angst coefficient". Delta smelt: center of population at about 91.5 km; low salvage densities. Chinook present in the salvage at significant but highly variable densities; not a big problem at this time. Exports are so low that density data are *unreliable*. If the small January storms were pumped for EWA, there might be some fish present. Also there is the Collinsville "starting gate" to worry about.
- Fish actions: None
- EWA assets: about $23 million plus some assets in San Luis plus 50 KAF on the SJR plus some other assets.

February 92

- Exports = 8,152
- Outflow = 30,852
- E/I = 22%
- X2 = 71.3
- N.B.: Discrepancy in the two models with respect to San Luis storage (CVP), which shows this full at the end of January. Part of the problem is that the DWRSIM model has a different delivery schedule built in (through March).
- Fish status: Salmon present in high densities by the middle of the month (but could relax E/I and pump some EWA water in the beginning of the month). San Luis is at about 1,000 KAF. Could implement fish triggers and reduce exports later in the month. Exports at a very low level in the beginning of the month, so density data are unreliable. There might be some fish present, so the

risks are "significant". Decision: Relax E/I and pump EWA water in the first week; let the second week go; restrict pumping to 5 kcfs for the last two weeks (bigger relative action than Game 1; winter run angst coefficient justifies this). Cost (net) = 160 KAF on the San Joaquin side ($3.75 million); relaxing E/I generated 35 KAF. In *biological benefits* so far, we have not factored in the "species relative sensitivity" in the same way we have used this in making EWA decisions.

- Water supply / quality: No actions. Export chlorides between 50 and 75; had been significantly higher in December.

March 92

- Exports = 8,227
- Outflow = 15,154
- E/I = 35%
- X2 = 71.8
- Fish status: Densities of steelhead falling (compared to historical levels); chinook present; delta smelt center of distribution at 99.5 (Jersey Point; Decker). Lots of striped bass.
- Fish actions: Could augment SJR flows by 1,000 cfs and cut exports by 1,000 cfs (to about 7,500 cfs) for the month. Decision: do it. Cost = 60 KAF. Reflects elevated densities of steelhead, chinook (including winter run); the San Joaquin is *very low* relative to the Sacramento, so the benefit will mostly be felt in the south delta and in the San Joaquin system itself.
- EWA actions: Purchase 75 KAF on the Export side
- Water supply / quality: No actions

April 92

- Exports = 2,904
- Outflow = 10,567
- E/I = 19%
- X2 = 74.7
- Fish status: Densities continue to decline; salmon situation getting very bad (chinook densities reach very high levels, especially in the middle of the month; mostly fall run smolts, probably San Joaquin origin). *Could* move VAMP forward to the first of April. San Joaquin actions in March could have brought these SJR fish down earlier. Decision: Start VAMP on 01 April.
- Water quality / supply actions: None.

May 92

- Exports = 484
- Outflow = 7,301
- E/I = 4%
- X2 = 78.5

- Fish status: Striped bass densities very high; delta smelt densities show as being high, but with prior actions, the densities would likely have been significantly lower.
- Fish actions: Pumping is VERY low, since inflow is very low. Decision (for this month and the rest of the year): Hold water in SJR reservoirs and release later for salmon benefits in October, November and December.
- Moving VAMP forward resulted in a project water loss of about 120 KAF creating a very serious condition in San Luis. There was no EWA cost to do this, however, since moving VAMP is free.

October/November/December (1992 - Water Year 1993)

- Exports = 3,579 / 4,391 / 11,092
- Outflow = 5,463 / 3,494 / 6,081
- E/I = 35% / 49% / 65%
- X2 = 85.7 / 87.7 / 84.2
- Fish status: No salmon in October or November; some juvenile salmon showing up in the second week of the month through the end of the month. Delta smelt: no worries; center of distribution in 87.7 in December; FMWT index previous fall is 157...very low. Striped bass present.
- EWA actions / fish actions: Move 13 KAF in each month from SJR to San Luis. Could relax E/I in the beginning of November and the end of December (two small storms) and generate some additional EWA water in San Luis. This might not be a good idea given the very low delta smelt FMWT index the previous year. EWA has 100+ KAF in San Luis. Probably ought not to pump the two small storms. Decision: do not pump the November storm. Could pump the early December storm, since delta smelt are not present. Decision: pump the early December storm for the first 2 weeks (60 KAF), while keeping exports at 3,500 for the rest of the month. Rationale: there are only a few salmon present for the rest of the month, but these are rare salmon. Net EWA gain = 40 KAF.
- N.B.: Large difference in the two models...George's model has 11 kcfs for the whole month, but this is an artifact of the distribution of inflow. This model matches pumping to actual flows, so go with the daily model. San Luis reservoir is also a discrepancy.

January 93

- Exports = 12,707
- Outflow = 56,520
- E/I = 20%
- X2 = 65.9
- Fish status: VERY high outflow; X2 at Roe; pumping is max'd out; splittail densities very high; delta smelt densities high in the last two weeks.
- Fish actions: Could implement fish triggers as a percentile (*e.g.* upper 25%-ile of the historic salvage) and cut pumping by 50%. Decision: do it. Cost: 240 KAF out of San Luis.
- Note: Came close to filling San Luis in Game 1 this year; San Luis did eventually spill and wipe out the EWA debt the next year. This may occur in this game, too. [put in previous year's notes.]

- EWA could buy water relatively cheaply; could wait a month to see how the hydrology works out and the water year type is designated. Decision: wait until next month.

February 93

- Exports = 12,298
- Outflow = 49,770
- E/I = 21%
- X2 = 60.9
- EWA is negative about 40 KAF after receiving the 50 KAF from the lease.
- Fish status: Striped bass present. Juvenile winter run present (brood year 1992; angst coefficient high). Splittail densities still very high. Steelhead densities elevated to 50-90 / KAF.
- Two large storms in February. Significant discrepancies between the two models, but the water is "pump-able".
- Based on the density patterns of splittail, it would make sense to retain the trigger (at 25/KAF) and remove outflow limits (Thabault) (for modeling purposes). Could implement steelhead triggers (at 10/KAF) too, which would take care of the rest of the month.
- EWA could buy some water: 130 KAF out of SOD (30 KAF out of a 10-year option; 100 KAF on the spot market). Net is a negative 213 KAF for the EWA in San Luis.
- Water users are getting very nervous; San Luis is still low, even with all the water in the delta.

March 93

- Exports = 12,291
- Outflow = 29,235
- E/I = 30%
- X2 = 63.3
- N.B. Apparent discrepancy in X2 between the two models is due to modeling difficulties...it's an artifact.
- Model shows very large recessions, which really didn't happen. We will play the game as if the recessions really happened, and protect around them.
- EWA could relax E/I and pump to San Luis in the middle of the month. Decision: Do it. Gain = 60 KAF to the EWA to recharge the Project account in Shasta.
- Fish status: Salmon, according to the salvage records, some EWA water could be pumped with impunity. *N.B. In this year, winter run sized fish did not show up in the salvage, whereas in most years about 35% of the winter run occurrence is in March.*

April 93

- Exports = 6,468
- Outflow = 39,900
- E/I = 13%

- X2 = 61.8
- Fish status: Striped bass densities lower (not usually seen below 100/KAF). Salmon show up in relatively high densities in the second week. Delta smelt: salvage density is low.
- Fish actions: Start VAMP at the regular time. This time, river conditions are better, especially on the San Joaquin side (including temperature).

May / June 93

- Exports = 4,581 / 12,441
- Outflow = 30,406 / 19,169
- E/I = 12% / 35%
- X2 = 63.3/ 67.4
- Fish status: VAMP in effect. Historically, delta smelt "take" was very high in May. However, with VAMP in effect, this would not happen. Delta smelt densities are relatively high, but the model shows some reduction in densities due to X2 moving downstream (N.B., this should not be the case, since the equation should not kick in with X2 this far downstream). VAMP results in at "take" of delta smelt 1/3 of the historic level. Splittail present at high levels.
- Fish actions: Operate VAMP through May. Could ramp exports up out of VAMP (in early June), since both delta smelt and splittail densities remain quite high until the last week of the month. Sudden increases in pumping in June (especially early June) could "undo" much of the good done by VAMP. On the other hand, these are densities we are worried about, and not "taking" fish would not increase their *densities* in front of the pumps; the good done by VAMP would likely not be *un-* done, it would just not be built upon. There was considerable concern over the persistence of high densities of both delta smelt and splittail, and the rate of change (increase) of pumping at the end of VAMP. Recall, San Luis is extremely low, due to VAMP and earlier actions. Decision: Ramp out of VAMP: ramp up from 1,500 (VAMP level) by 3,000 cfs per week for 3 weeks. Fourth week, no ramp restrictions; E/I will be controlling. Net gain in EWA = 110 KAF. (Cost of this action = 40 KAF).
- EWA action: Relax E/I last week of June and capture EWA water. Net EWA gain = 0 (!). Saved 1,000 delta smelt (both months); lots of striped bass (1 million) ; 500 chinook; 500 splittail. Except for striped bass, these numbers are rather puny.

July / August / September 93

- Exports = 13,100 / 9,300 / 10,300
- Outflow = 8,000 / 4,000 / 3,300
- E/I = 51% / 56% / 65%
- X2 = 75 / 83 / 87
- Fish status: Striped bass densities remain high. Splittail densities are quite variable; delta smelt densities are variable in July, insignificant in August and September
- EWA actions: Could move Shasta and San Joaquin water starting in July and August and take advantage of pumping opportunities. Also, could wait and use this water for instream flows later in the year. Decision: Move 60 KAF from Shasta to San Luis in August (net = 48 KAF after carriage

water is subtracted); move 50 KAF from San Joaquin to San Luis (net = 45 KAF after conveyance losses).

WHAT WE LEARNED

- Many lessons in this game
- We can stop here and use Tuesday to prepare for Quinn/Spear.
- This was a more difficult game, especially for water users, with fewer assets/tools. The implementation of VAMP hurt supplies. There was a struggle to not get too much debt.
- It is difficult to work around limited resources. A more "static" approach might give biological results which would be more "comfortable" than use of an EWA.
- Fewer resources and empty storage at the beginning created a problem with EWA, but the lower pumping capacities compensated for this, at least in part. In the future, however, both demand and infrastructure will grow, and this will continue to put pressure on the environment.
- The increase in $10 million produced a disproportionate benefit to the EWA (given other limits).
- The flexibility in the EWA approach helps both water and fish.
- The limited resources in this game still produced good gains in protection (especially compared to the base). As new tools come on line, new rules need to be developed which will result in sharing or other operations changes to cope with emerging realities. VAMP results in both many benefits (for fish) and many threats (for supplies).
- Relative degree of reliance on tools with different games needs to be emphasized to Quinn/Spear. Reliance on debt (and how far we went into debt) is important to explain. Apples-to-apples comparisons are difficult if not impossible.
- Important to look at export/flow patterns with games v. fixed criteria. Groundwater is in the EWA asset base, but didn't get used much. In-out is a big constraint on usefulness.
- Increase in Shasta storage is something that needs to be decided upon and moved on soon, if it is going to be a part of the "real" world.
- Separate from the water and the resources, there is a need to decide how to rent space and swap locations for water. Demand and storage patterns (including demand shifting) get complementary under some circumstances; some nice fits, which can be a big advantage down the road.
- There needs to be a "seamless" marriage between the EWA and environmental restoration.

END

GAME 4 - Biological 1994 & 1995

Rus Brown has finished the "base" for Game 4.

This exercise will be the completion of Game 4, starting with 1994.

Game 4 still has AFRP actions incorporated into the baseline. July ramping will be included, etc.

Resources:

No water assets; debt of 50 KAF in San Luis; have purchased options for 4.8 million - need to call them in or the price will rise. Bank: $21 million. No water upstream.

Recap of 1993:

- Year began dry; storms in January and smaller storm in February.
- Used fish triggers to reduce exports early
- Let VAMP occur (5 wks); ramped up exports to full pumping in June and July.
- Start San Luis fairly full: 850 - 800 KAF in San Luis.

Baseline conditions

Baseline pumping fairly high; much water. Pumping to meet daily demand. Will be easy to repay the debt in San Luis, unless very aggressive restrictions are imposed.

Could start putting water into groundwater.

Pumping should be only 1,500 (pumping limit) for VAMP (second half of April; first half of May). Keep at 1,500 for the whole period.

N.B. Some measures (releases) were implemented, especially in Oct. and Nov. HOWEVER, water quality measures were not automatically incorporated into the base.

Extension of ramping is part of Delta Action 5, which is different from other games (esp. 5).

VAMP ramp for the last two weeks of May might be over-protective relative to what FWS would normally require.

Change the VAMP target to 3,200 cfs.

Need to go back and re-do the fall season of 1994 for Game 5 (starting in the second week in November).

October 93

- NO action.

November 93

- Close Cross Channel Gates (whole month)
- Chlorides good through the month

December 93

- Export rate in base is about 7 kcfs due to a flow recession.
- Action: maintain pumping at 7 kcfs for the entire month. Spring run yearlings and other similar-sized salmon migrating through the delta; action taken to improve in-delta conditions related to survival.
- Water cost for is 180 KAF for the month.
- Fish density in salvage is relatively low.
- Some excess outflow during small storms; MIGHT be able to back up some water. Feather river "deal" might be cut; Shasta is full (no opportunity). Not possible to back up any water.

January 94

- Exports: 11,354
- Outflow (surplus) 3,366; total outflow = 7,870
- E/I = 59%
- X2 = 80.5
- Base run: San Luis fills in the middle of January; with restrictions, San Luis debt would still be paid back, unless there would be further restrictions.
- Delta smelt densities rise by an order of magnitude during the month; chinook disappear.
- No need for salmon protection in January.
- EWA Decision: Put 20 KAF out of San Luis into Kern Water Bank. Would extend the debt in San Luis, but there is a probability of payback, and the Kern deposit would result in EWA collateral.

February 94

- Exports = 6,652 cfs
- Outflow = 25,416
- E/I = 21%
- X2 = 70.8
- San Luis is within 10 KAF of filling
- Could continue groundwater deposit into Kern unless there is a need for a fish action.
- No fish action needed; EWA action: Pass 20 KAF from the delta through San Luis into the Kern Water Bank.
- Chipps Is. Fish data: Delta smelt are abundant; other species present (incl. chinook).

March 94

- Exports = 5,511
- Outflow = 11,122
- E/I = 31%
- X2 = 74
- Fish densities are rising; assume that the salmon present are progeny of previous fall's winter run spawning.
- Fish Decision: Restrict pumping to 4 kcfs for the month of March. (Cost will be less since San Luis is nearly full, and will probably spill).
- EWA has options on l100 KAF to spend on the San Joaquin side
- EWA cost is 60 KAF for restrictions in March.
- Add 2,000 cfs to SJR flow for the last 2 weeks of March.
- Use 60 KAF out of reservoir storage.

- Purchase 100 KAF in options, March. Release 60 KAF of this to increase SJR instream flows.
- Could back up 60 KAF in Folsum; there would be an instream flow consequence; could result in a stranding problem without appropriate ramping. Could go for about half of the amount, since the Folsum storage level is so low, and the streamflow situation is not good. Could adjust instream flow requirement to 1,000 cfs, moving 30 KAF back up into Folsum. This would be half of the EWA releases in the San Joaquin. EWA action: Do it.

April 94

- Exports = 2,873
- Outflow = 8,551
- E/I = 22%
- X2 = 77.1
- Could carry the VAMP flows through the first 2 weeks of April (2,000 cfs). Did augment SJ flows for the first two weeks by 2000. Reduced flow to VAMP flow of 3200. Rationale for going from 40000 to 3200 is because VAMP exports are 1,500 and there is an opportunity to "balance" flows against pumping rate.

May 94

- Exports = 2,115
- Outflow = 8,032
- E/I = 17%
- X2 = 78.5
- Large delta smelt spike.
- EWA owes about 10 KAF in the export area because of an automatic 50 KAF input.
- No action

June 94

- Exports =
- Outflow =
- E/I =
- X2 =
- EWA gain = 120 KAF through relaxation of E/I

July thru September 94

	July	August	September
- Exports =	5,873	11,874	7,930
- Outflow =	4,000	2,992	2,070
- E/I =	40%	65%	65%

- X2 = 88.2 88.7 89.9

- Export chlorides have been low but start up earlier; still below historic levels.

- No fish actions through September.

WATER YEAR 1995s

October, November, December 94

- Exports = 5,000

- Outflow =

- E/I =

- X2 =

- Fish status: Very poor FMWT index for delta smelt. No salmon in Oct or Nov. Salmon show up in mid-December.

- Release American River water to downstream areas by watching weather and water temperatures (lower temperatures usually start in November). Jump to next AFRP step in November.

- Relax E/I in December? There is precedent. Do it for first week in December; 200 cfs for the month (average). Water consequence is a very small degradation in water quality (chlorides).

- Transfer 30 KAF into San Luis.

- Salmon (spring run yearlings; juvenile winter run) present in the delta in last two weeks of December: Reduce exports to 8,000 cfs for the second half (extend into and through January). Cost to EWA = 60,000.

January 95

- Exports =

- Outflow =

- E/I =

- X2 =

- Maintain export levels at 8,000 cfs through the month. Very low FMWT index for delta smelt in the previous fall; spring run and winter run salmon present.

- Oroville, Shasta, etc. getting quite full. All spill at the end of January.

- Exercise EWA and increase American River flows by 2,000 cfs (250 higher than AFRP) and extend through January. Add to EWA debt.

- Debt from Folsum releases is 250 cfs for about a week (240 KAF debt). Confidence that Folsum will spill.

February 95

- Exports = [*obtain from model*]

- Outflow =

- E/I =
- X2 =
- No action

March 95

- No action

April / May 95

- Fish status = salvage data is misleading this year, due to very low historic pumping.
- OK for first two weeks
- VAMP begins in week-3
- EWA debt = 107 KAF N.B. San Luis did not fill, so debt *not* eliminiated.
- Exports @ 3,000 cfs during VAMP in this scenario.
- No fish actions

June 95

- First week, exports at 3,000; second week exports at 4,500; third week at 6,000; fourth week at full pumping (12,500 cfs). Justification: late peak in outmigration of San Joaquin salmon outmigration.
- EWA cost = 330 KAF.
- About $40 million left in EWA bank.

July, Aug, Sep 95

- No action for fish
- Purchase 200 KAF in options from San Joaquin side for delivery next year.

Observation (Briggs).

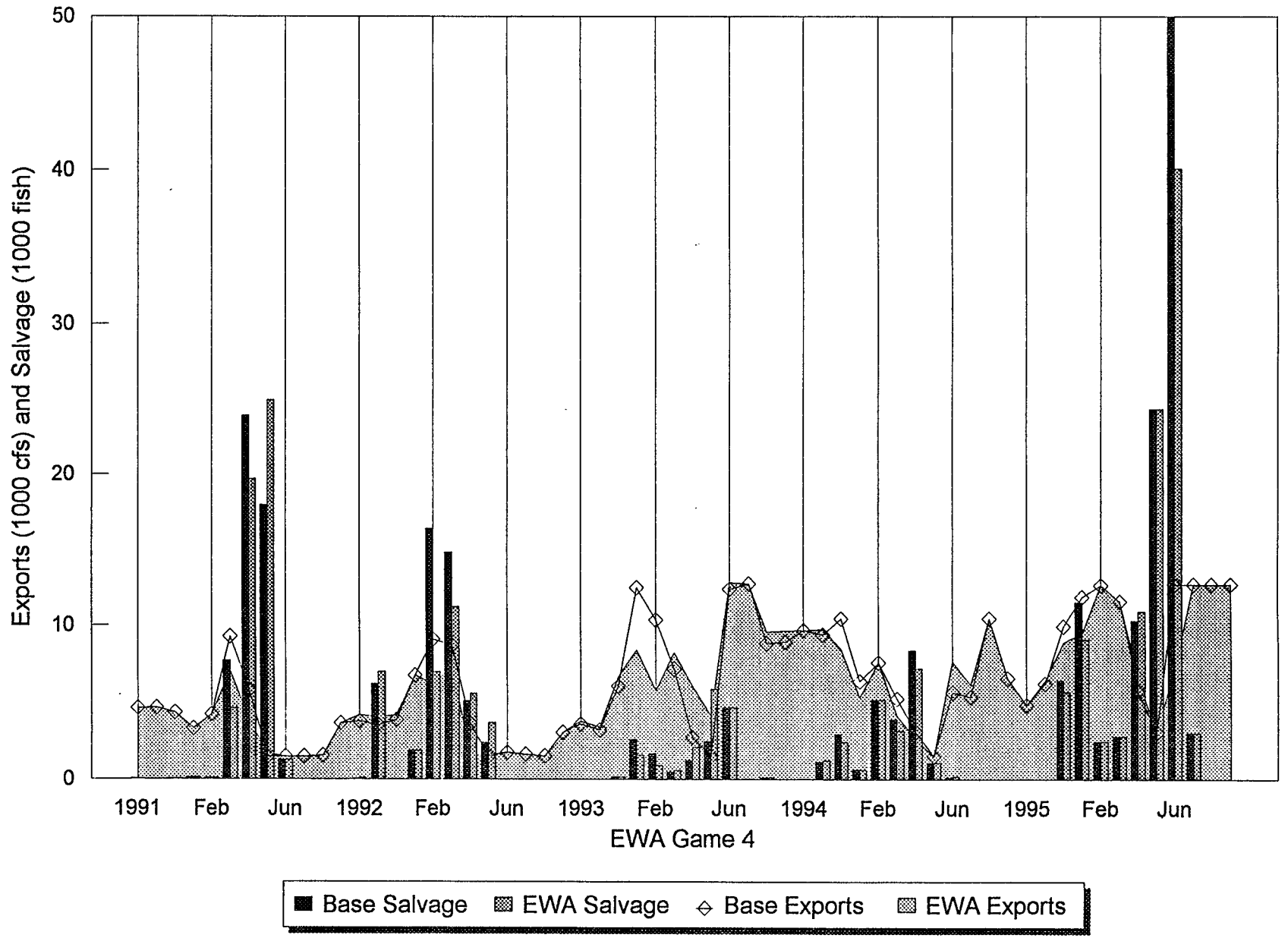
We have assumed money and operations, and have actually made water quality gains without really any special effort...water quality "rides on top" of the game. Some additional water quality targets can be factored into the process for Quinn/Spear.

It will be interesting to see how demand patterns feed back into water quality targets.

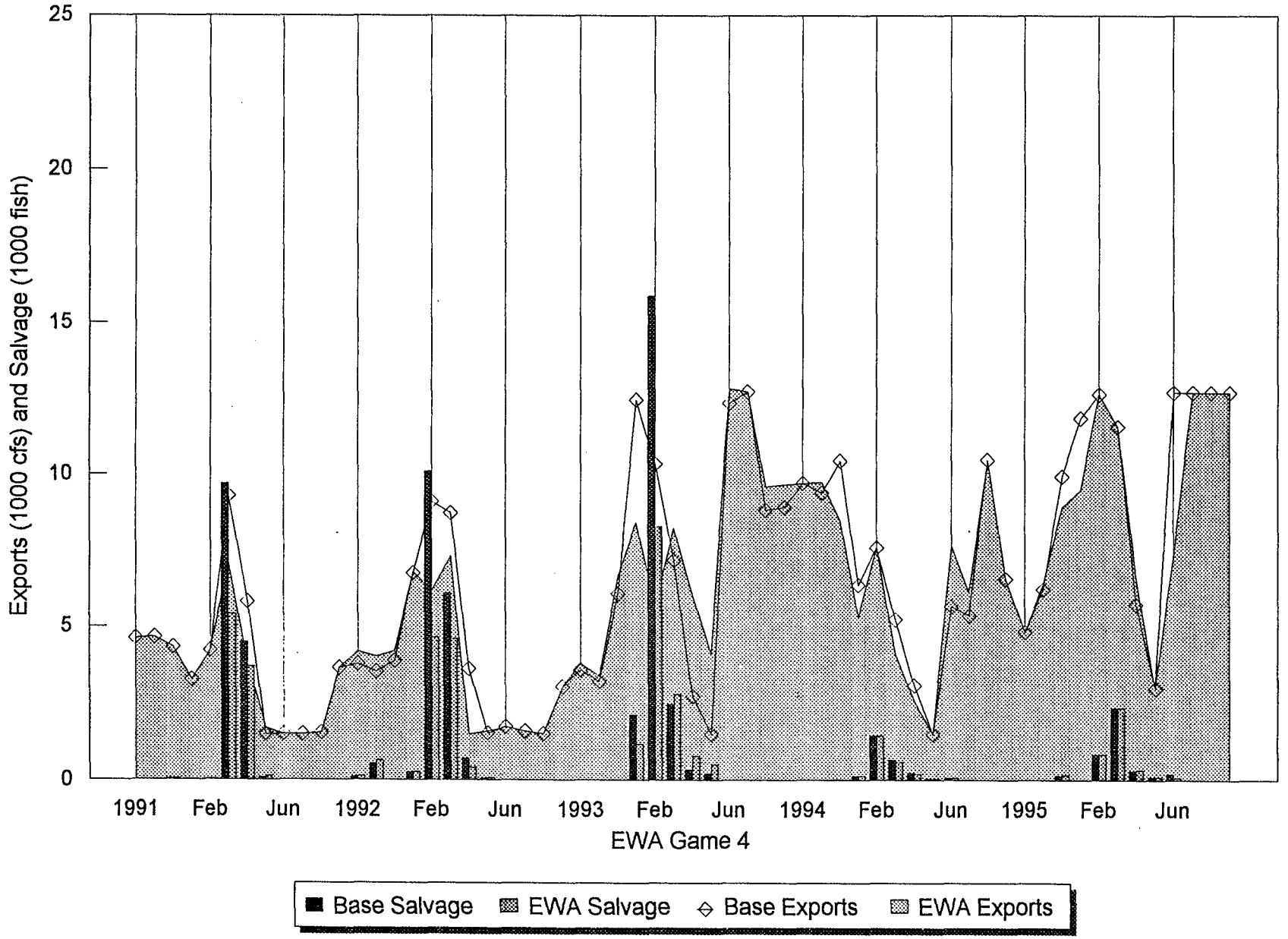
N.B. Game 5, Nov. 1994. Inappropriate E/I relaxation. This will be "backed out" of the model run.

END

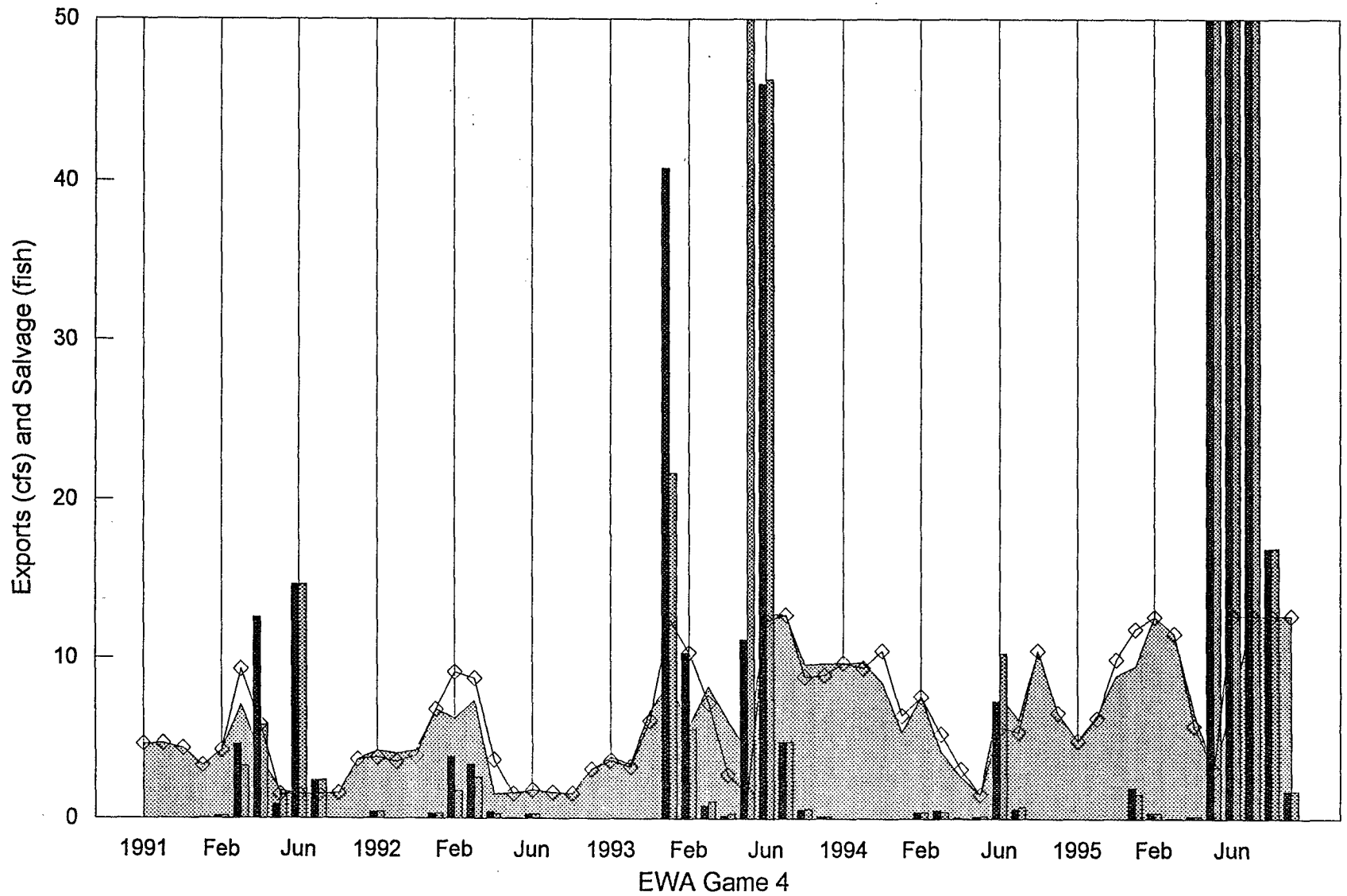
Chinook Benefits from EWA Game 4



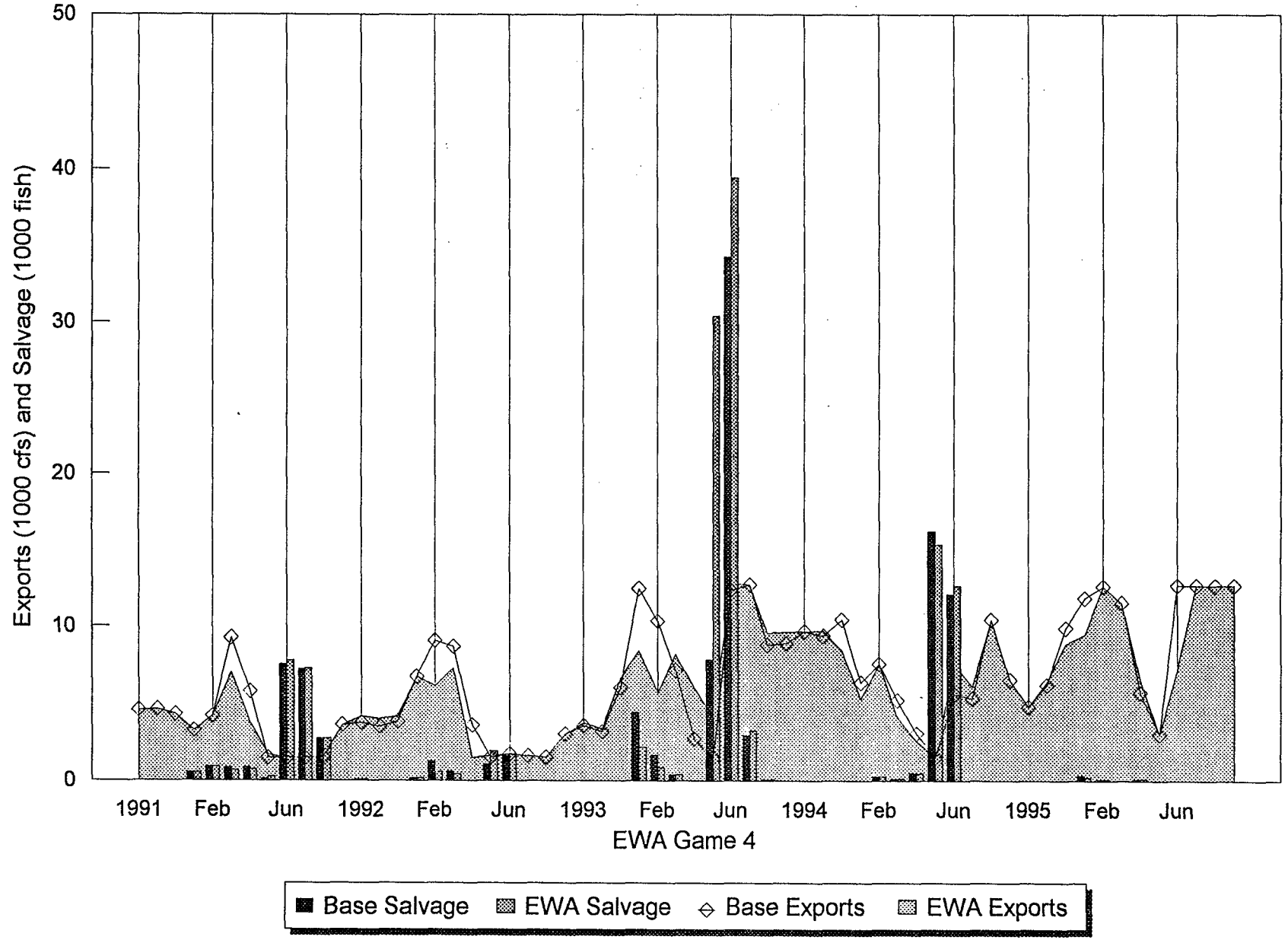
Steelhead Benefits from EWA Game 4

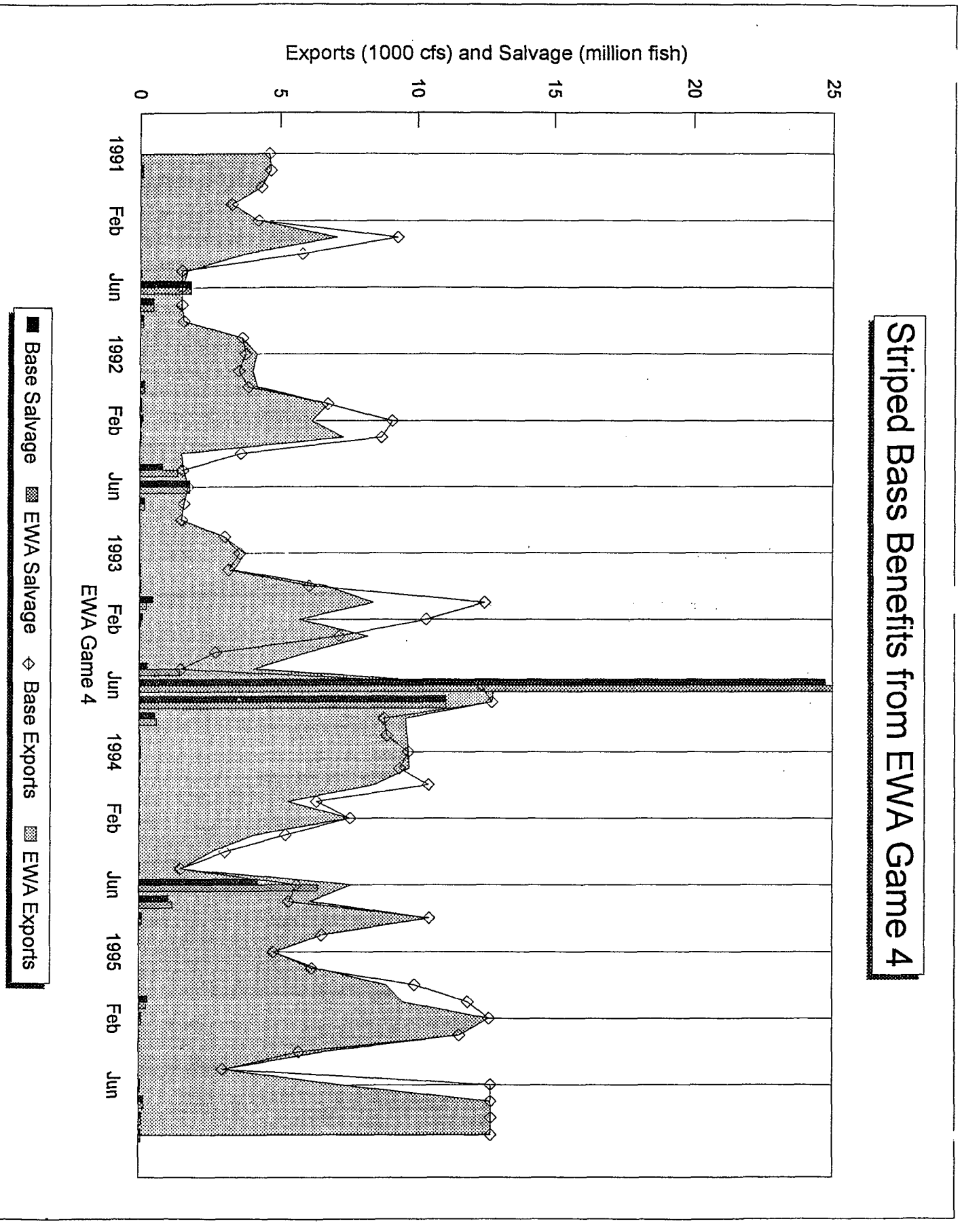


Splittail Benefits from EWA Game 4

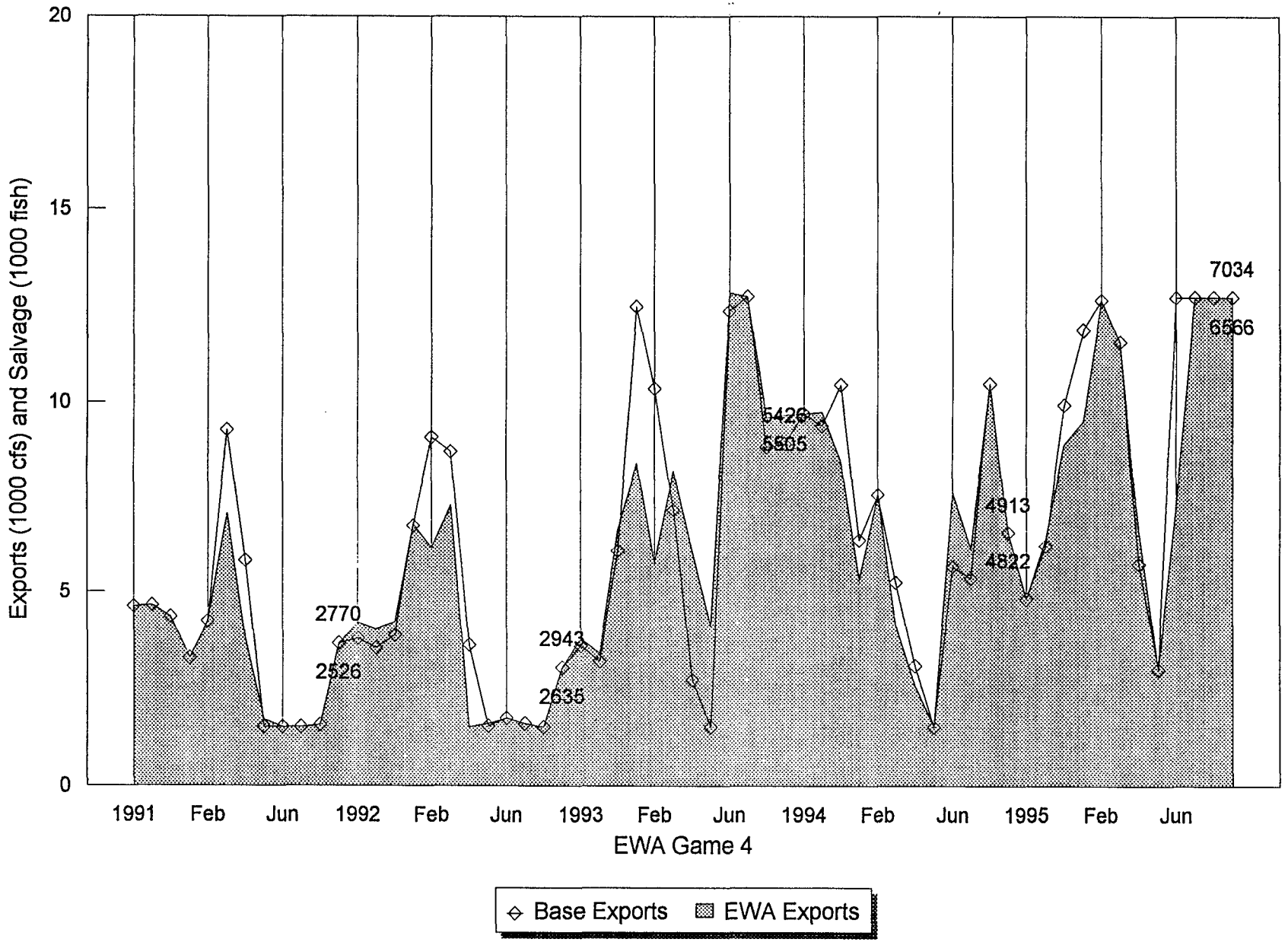


Delta Smelt Benefits from EWA Game 4




Striped Bass Benefits from EWA Game 4
Exports (1000 cfs) and Salvage (million fish)
0
5
10
15
20
25
1991
Feb
Jun
1992
Feb
Jun
1993
Feb
Jun
1994
Feb
Jun
1995
Feb
Jun
EWA Game 4
Base Salvage
EWA Salvage
Base Exports
EWA Exports

Export Shifting for EWA Game 4



Game 5

Game 5 / Version X - Day 1/Stage 1

June 17, 1999

Basic Description: Game X represents conditions that would be in place on Day 1 of Stage 1. No new facilities would be available. *Game X is a version of Game 5 with additional actions/tools tested. Major new feature is EWA receives one-half of expanded Banks pumping.*

Beginning Assets:

- $50 million annual fund for water purchases.
  - 10-year lease options (215 TAF)
  - 10-year purchase options (550 TAF)
  - one-year purchase option (750 TAF)
- Ground Water Banks
  - Semitropic (200 TAF of storage space available)
  - Kern (100 TAF of storage space available)
- Expanded Shasta (50 TAF per year if reservoir fills)
- Debt carrying ability in project reservoirs (primarily San Luis and Shasta)

Asset Generating Capability:

- Relaxation of Export/Inflow standards - water can be backed up into reservoir EWA accounts or exported to San Luis EWA account.
- Export water to San Luis or groundwater banks when projects were not at capacity.
- **New:** EWA receives one-half of exports using expanded Banks.

Baseline Conditions:

- 1995 demand level
- 8500 cfs expanded capacity for Banks pumping plant - one-half of pumping above 6300 cfs will be placed in San Luis EWA account.
- Accord + upstream AFRP only; no in-Delta AFRP
- No VAMP

Actions Taken:

- Relaxed E/I standard in dry and wet years to export water into EWA account in San Luis reservoir.
- Limited project exports in winter and spring to reduce fish being drawn to pumping plants.
- Generated a VAMP like restriction on exports along with increased SJ flows.
- Backed up water into Shasta and Folsom EWA account when possible coincident with export reductions.
- Purchased water in San Joaquin reservoirs for release to rivers and Delta.

- **NEW:** released storage water to rivers in fall and winter for instream benefits, then recovered water at export pumps and stored in San Luis EWA account. Took on debt in reservoirs or exchanged for water purchased.
- **NEW:** released purchased water from SJ in June, backed up water into Folsom EWA account (reduced Folsom releases which were being made for export and delta outflow requirements). Releases benefitted SJ salmon and Delta delta smelt. Higher storage level in Folsom protected summer water temperatures and provided for minimum AFRP flow releases that are prescribed based on storage and inflow levels.
- **NEW:** cut exports June and July from 1500 to 500 cfs - took on debt in San Luis - backed up water into NOD reservoirs to pay off debts from previous fall-winter. Helped preserve coldwater pools in reservoirs + helped preserve delta smelt at pumps which had near 1000 smelt per TAF of export (120 TAF of export reductions amounted to 100,000 delta smelt saved). Assumption that storage releases cut back to back up water into reservoirs were above minimums, AFRP, or winter-run requirements. Shasta, Oroville, or Folsom were options.
- **NEW:** Shifted EWA storage among reservoirs by adjusting releases to provide instream and reservoir environmental benefits - maximize benefit of EWA storage NOD.
- **NEW:** Released water from reservoirs (took on debt or used assets) to fill in outflow troughs that restricted exports at pumps in wet years. Took on EWA water in San Luis as a consequence - Projects also gained extra pumping capacity as well.

Game 5 - Day 1/Stage 1

Basic Description: Game 5 represents conditions that would be in place on Day 1 of Stage 1. No new facilities would be available.

Beginning Assets:

- $50 million annual fund for water purchases.
  - 10-year lease options (215 TAF)
  - 10-year purchase options (550 TAF)
  - one-year purchase option (750 TAF)
- Ground Water Banks
  - Semitropic (200 TAF of storage space available)
  - Kern (100 TAF of storage space available)
- Expanded Shasta (50 TAF per year if reservoir fills)
- Debt carrying ability in project reservoirs (primarily San Luis and Shasta)

Asset Generating Capability:

- Relaxation of Export/Inflow standards
- Export water to San Luis or groundwater banks when projects were not at capacity.

Baseline Conditions:

- 1995 demand level
- 8500 cfs expanded capacity for Banks pumping plant
- Accord + upstream AFRP only; no in-Delta AFRP
- No VAMP

Actions Taken:

- Relaxed E/I standard in dry and wet years to export water into EWA account in San Luis reservoir.
- Limited project exports in winter and spring to reduce fish being drawn to pumping plants.
- Generated a VAMP like restriction on exports along with increased SJ flows.
- Backed up water into Shasta and Folsom EWA account when possible coincident with export reductions.
- Purchased water in San Joaquin reservoirs for release to rivers and Delta.

Water Operations Summary: Game 5. Year 2001 water year.
May 28, 1999 Draft

GAME 6

Scenario: No in-Delta AFRP			Target Year: End of Stage 1
Possible Water Supply Measures	Details	EWA/ Users Division	How to Model How to Game
South Delta Program - 8.5 kcfs	8.5 kcfs. Expansion of Corps Criteria. 6.4 kcfs + 1/3 SJR during November - March. 8.5 kcfs during summer (dates?)	Projects below E/I. EWA above E/I	Model in baseline.
JPOD. No individual State/ Federal sublimits	No state or federal sublimits apply	Projects below E/I. EWA above E/I	Model in baseline.
Allow E/I variances			EWA may allow pumping above E/I for credit..
Kern Water Bank	200 kaf storage. 20 kaf/ month in. 20 kaf /month out.	Projects/ EWA share	Operate Project storage in model. Operate EWA share in game. Capacity is high priority -- no preemption by Kern.
Semitropic high priority storage	200 kaf storage 20 kaf/ month in. 10 kaf/ month out.	EWA	Operate by hand in game.
Shasta Dam Expansion	50 kaf storage	EWA	Operate in game
Water purchases	See attached description	EWA	Operate by hand in game
Demand shifting	100 kaf. Short term storage lease in San Luis.	EWA	Operate by hand in game
Access Surplus Capacity		EWA	Operate by hand in game

10.3

SHAVELY FORD → 200 PROJECT 100 EWA

Groundwater	GAME 5	GAME 6
PROJECTS	100 TAF	300 TAF
EWA	300 TAF	400 TAF

Water Operations Summary: Game 5. Year 2001 water year.
May 28, 1999 Draft

Initial Conditions

- All storage is empty
- Long-term options begin in the first year of simulation

EWA Budget

$50 million/year, paid on October 1 of each year. Funds may accrue. The EWA may borrow up to $50 million of future income. EWA funds accrue interest at 5% per year. Borrowing costs 5% per year. Capital costs for assumed facilities are outside the game. EWA may build up its fiscal reserves by selling or leasing its rights to water or facilities.

Transfers

See Water Purchase Schedule

Price Schedules

Discretionary and operating costs must be paid for using the EWA budget. These costs include:

- Water Purchases -- See Water Purchase Schedule
- Water sales by EWA -- Price to be negotiated during game.
- Groundwater pumping costs --

  Kern at $100/af
  Semitropic at $200/af

- Demand Shifting

  $100/af to rent up to $100 kaf of storage in San Luis from MWD

Water Operations Summary: Game 5. Year 2001 water year.
May 28, 1999 Draft

Intention to shift storage must be declared by June 1
Water must be paid back by January 1 of next year or $1000/af payment

Modeling Basis

Based upon the matrix above, the modeling upon which the game would be founded would be run with the following assumptions:

- o 1995 Level of Development
- o Accord + VAMP + upstream AFRP + Trinity
- o South Delta Improvements (limited 8.5 kcfs)
- o Unlimited JPOD

- o VAMP San Joaquin flow schedule. Biological opinions flows.

Water Supply Evaluation

The results from the modeling basis plus any yield developed because (1) EWA water supplies San Luis lowpoint requirements and (2) by borrowing EWA groundwater storage.

Game Rules

- o EWA has the right to carry debt and to use Project facilities, provided it can assure no harm, unless arrangements for compensation are agreed to in advance. Thus, the EWA may borrow against future water supplies, may shift Project storage from upstream storage to downstream storage, etc., provided that it can make the Project's whole before the water is needed.
- o EWA must have secure collateral for any borrowing it undertakes within a year. It may carry over debt (if otherwise allowed) without specifically identified collateral.
- o Unless otherwise specified, EWA has low priority access to Project facilities.
- o Movement of water through the Delta when outflow is controlling has a carriage water cost of 20%. Backing water upstream via export reductions when outflow is controlling reduces carriage water by 20%. Moving water from the San Joaquin

tributaries has a cost of 10%.

- o Projects may borrow EWA storage within San Luis in order to satisfy low point requirements.
- o Projects may borrow EWA groundwater storage on a low priority basis.

GAME 5 Water Year 1991 Values in italics are calculated

Game 5		IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases														
San Joaquin River Market Releases									14	15				
Delta Cross Channel Closed?														
Change in CCFB/Tracy Diversions			*0*	*0*	*0*	*0*	*0*	*-30*	*0*	*-50*	*0*	*-60*	*-60*	*-60*
Carriage Water														
Change in Delta Outflow			*0*	*0*	*0*	*0*	*0*	*30*	*14*	*65*	*0*	*60*	*60*	*60*
South of Delta market "deliveries"														
MWD Shift Water to/from EWA														
Change Groundwater Storage			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage			*0*	*0*	*0*	*0*	*0*	*-30*	*0*	*-50*	*0*	*-60*	*-60*	*-60*
Water Generated by E/I Relaxations			0	0	0	0	0	85	0	0	0	0	0	0
End of Month Values for EWA Accounts			0											
	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		0												
Stored EWA Sacto		0										60	120	180
Stored EWA SJR						50	50	100	86	71	71	71	71	71
SemiTropic	200	0												
Kern	100	0												
EWA San Luis		0						(30)	(30)	(80)	(80)	(140)	(200)	(260)
Borrowed MWD		0												
Project Debt to EWA in SLR		0												
Upstream Surplus Capture			0	0	0	0	0	0	0	0	0	0	0	0
Delta Surplus Capture			0	0	0	0	0	0	0	0	0	0	0	0
Purchased														
Year Type: 1 for dry/critical. 0 otherwise			*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River														
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water														
Call spot water														
San Joaquin Tribs														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*120*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water						50								
Call spot water														
Export Area														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water								100						
Call spot water														
Cost of Options			*6.6*											
Leasing cost			*15*											
Cost of buying water options						3.75		13.5						
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA			*50*											
Interest														
Financial Balance		*0*	*28.4*	*28.4*	*28.4*	*24.65*	*24.65*	*11.15*	*11.15*	*11.15*	*11.15*	*11.15*	*11.15*	*11.15*
Approximate buying power			170.06	170.06	170.06	147.60479	147.605	66.7665	66.7665	66.7665	66.7665	66.7665	66.7665	66.7665
Purchased but undelivered			100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993	1994	1995	
250	420	280	280	430	Purchases
85	0	140	190	15	Relaxed Stds
0	0	0	0	0	Efficiency
0	0	0	230	165	Upstream Surplus Capture
0	0	0	260	0	Delta Surplus Capture

GAME 5 *Water* *1992* *Values in italics are calculated*

Game 5		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases											62		
San Joaquin River Market Releases								30					
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*81*	*81*	*82*	*0*	*35*	*-50*	*-40*	*0*	*0*	*51*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*-81*	*-81*	*-82*	*0*	*-35*	*50*	*70*	*0*	*0*	*11*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*81*	*81*	*82*	*0*	*35*	*-50*	*-40*	*0*	*0*	*51*	*0*	*0*
Water Generated by E/I Relaxations		0	0	0	0	0	0	0	0	0	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta													
Stored EWA Sacto		120	60	0	0	100	100	100	100	100	38	38	38
Stored EWA SJR		47	23	0	50	50	100	70	70	70	70	70	70
SemiTropic	200												
Kern	100												
EWA San Luis		(179)	(98)	(16)	(16)	19	(31)	(71)	(71)	(71)	(20)	(20)	(20)
Borrowed MWD													
Project Debt to EWA in SLR													
Upstream Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water						100							
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water					50								
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water						170							
Call spot water													
Cost of Options		*6.6*											
Leasing cost		*15*											
Cost of buying water options					3.75	37.95							
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.9*											
Financial Balance		*40.4356*	*40.4356*	*40.4356*	*36.6856*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*
Approximate buying power		242.129	242.129	242.129	219.674	-7.57111	-7.57111	-7.57111	-7.57111	-7.57111	-7.57111	-7.57111	-7.57111
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993
250	420	280
85	0	140
0	0	0
0	0	0
0	0	0

GAME 5 *Water* *1993* Values in italics are calculated

Game 5		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*-50*	*0*	*0*	*100*	*60*	*120*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*15*	*85*	*-45*	*0*	*70*	*-100*	*-550*	*-275*	*270*	*120*	*240*
Carriage Water													
Change in Delta Outflow		*0*	*-15*	*-85*	*45*	*0*	*-70*	*50*	*550*	*275*	*-170*	*-60*	*-120*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*15*	*85*	*-45*	*0*	*70*	*-100*	*-550*	*-275*	*270*	*120*	*240*
Water Generated by E/I Relaxations		0	0	70	0	0	70	0	0	0	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta								50	50	50	-50	-110	-230
Stored EWA Sacto		38	15	0	0	0	0	0	0	0	-50	-110	-230
Stored EWA SJR		70	70	70	70	70	120	120	120	120	0	0	0
SemiTropic	200												
Kern	100												
EWA San Luis		(20)	(5)	80	35	35	105	5	(545)	(820)	(550)	(430)	(190)
Borrowed MWD													
Project Debt to EWA in SLR													
Upstream Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Trib													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water					180								
Call spot water													
Cost of Options		*6.6*											
Leasing cost		*15*											
Cost of buying water options					24.3								
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.6*											
Financial Balance		*27.7518*	*27.7518*	*27.7518*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*
Approximate buying power		166.178	166.178	166.178	20.6693	20.6693	20.6693	20.6693	20.6693	20.6693	20.6693	20.6693	20.6693
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993
250	420	280
85	0	140
0	0	0
0	0	0
0	0	0

GAME 5 Water 1994 Values in italics are calculated

Game 5		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*-115*	*0*	*0*	*0*	*-100*	*-60*	*0*	*0*	*45*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases							50	50					
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*50*	*-120*	*0*	*170*	*-60*	*20*	*-160*	*140*	*0*	*45*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*-50*	*5*	*0*	*-170*	*110*	*-70*	*100*	*-140*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*50*	*-120*	*0*	*170*	*-60*	*20*	*-160*	*140*	*0*	*45*	*0*
Water Generated by E/I Relaxations		0	50	0	0	0	0	0	0	140	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		-230	-230	-115	-115	-115	-115	-15	45	45	45	0	0
Stored EWA Sacto		-230	-230	-115	-115	-115	-115	-115	-115	-115	-115	-115	-115
Stored EWA SJR		0	0	0	50	50	50	0	0	0	0	0	0
SemiTropic	200												
Kern	100												
EWA San Luis		(190)	(140)	(260)	(260)	(90)	(150)	(130)	(290)	(150)	(150)	(105)	(105)
Borrowed MWD													
Project Debt to EWA in SLR													
Upstream Surplus Capture		0	0	230	0	0	0	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	170	90	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water					100								
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water					50								
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water					30								
Call spot water													
Cost of Options		*6.6*											
Leasing cost		*15*											
Cost of buying water options					18.25								
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.5*											
Financial Balance		*32.3281*	*32.3281*	*32.3281*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*
Approximate buying power		193.582	193.582	193.582	84.3001	84.3001	84.3001	84.3001	84.3001	84.3001	84.3001	84.3001	84.3001
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

Summary

1991	1992	1993
250	420	280
85	0	140
0	0	0
0	*0*	*0*
0	0	0

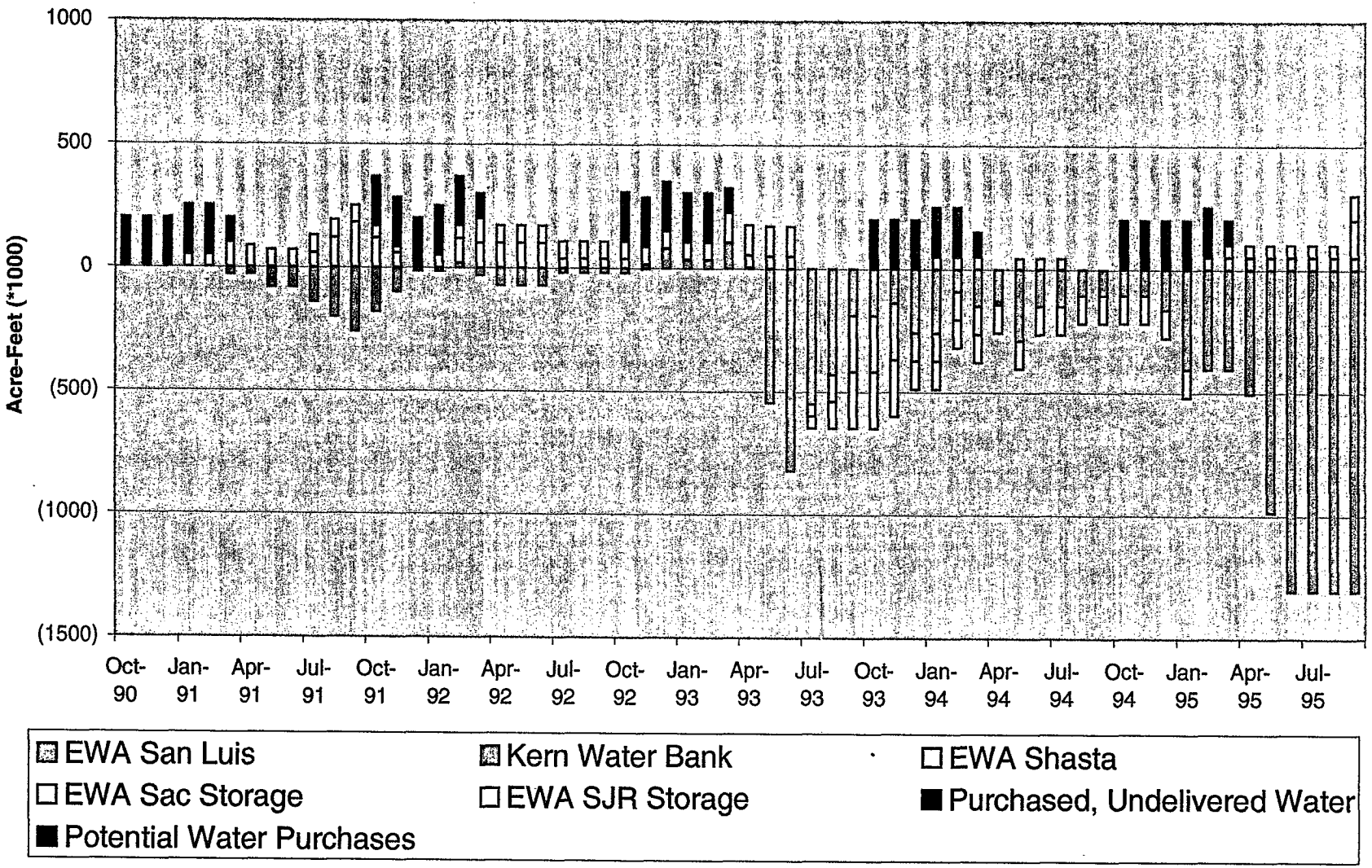
GAME 5 *Water 1995* Values in italics are calculated

Game 5		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*-50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*0*	*-60*	*-240*	*0*	*0*	*-100*	*-480*	*-320*	*0*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*0*	*60*	*240*	*-50*	*0*	*100*	*480*	*320*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*0*	*-60*	*-240*	*0*	*0*	*-100*	*-480*	*-320*	*0*	*0*	*0*
Water Generated by E/I Relaxations		0	0	15	0	0	0	0	0	0	0	0	0
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		0	0	0	0	50	50	50	50	50	50	50	50
Stored EWA Sacto		-115	-115	-115	-115	0	0	0	0	0	0	0	150
Stored EWA SJR		0	0	0	0	0	50	50	50	50	50	50	100
SemiTropic	200												
Kern	100												
EWA San Luis		(105)	(105)	(165)	(405)	(405)	(405)	(505)	(985)	(1305)	(1305)	(1305)	(1305)
Borrowed MWD													
Project Debt to EWA in SLR													
Upstream Surplus Capture		0	0	0	115	50	0	0	0	0	0	0	0
Delta Surplus Capture		0	0	0	0	0	0	0	0	0	0	0	0
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													150
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	100	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*		*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													50
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	50	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water					*30*								
Call spot water					*100*								
Cost of Options		*6.6*											
Leasing cost		*15*											
Cost of buying water options					13								10
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.9*											
Financial Balance		*43.4102*	*43.4102*	*43.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*20.4102*
Approximate buying power		259.941	259.941	259.941	182.097	182.097	182.097	182.097	182.097	182.097	182.097	182.097	122.216
Purchased but undelivered		100	100	100	100	100	50	0	0	0	0	0	0

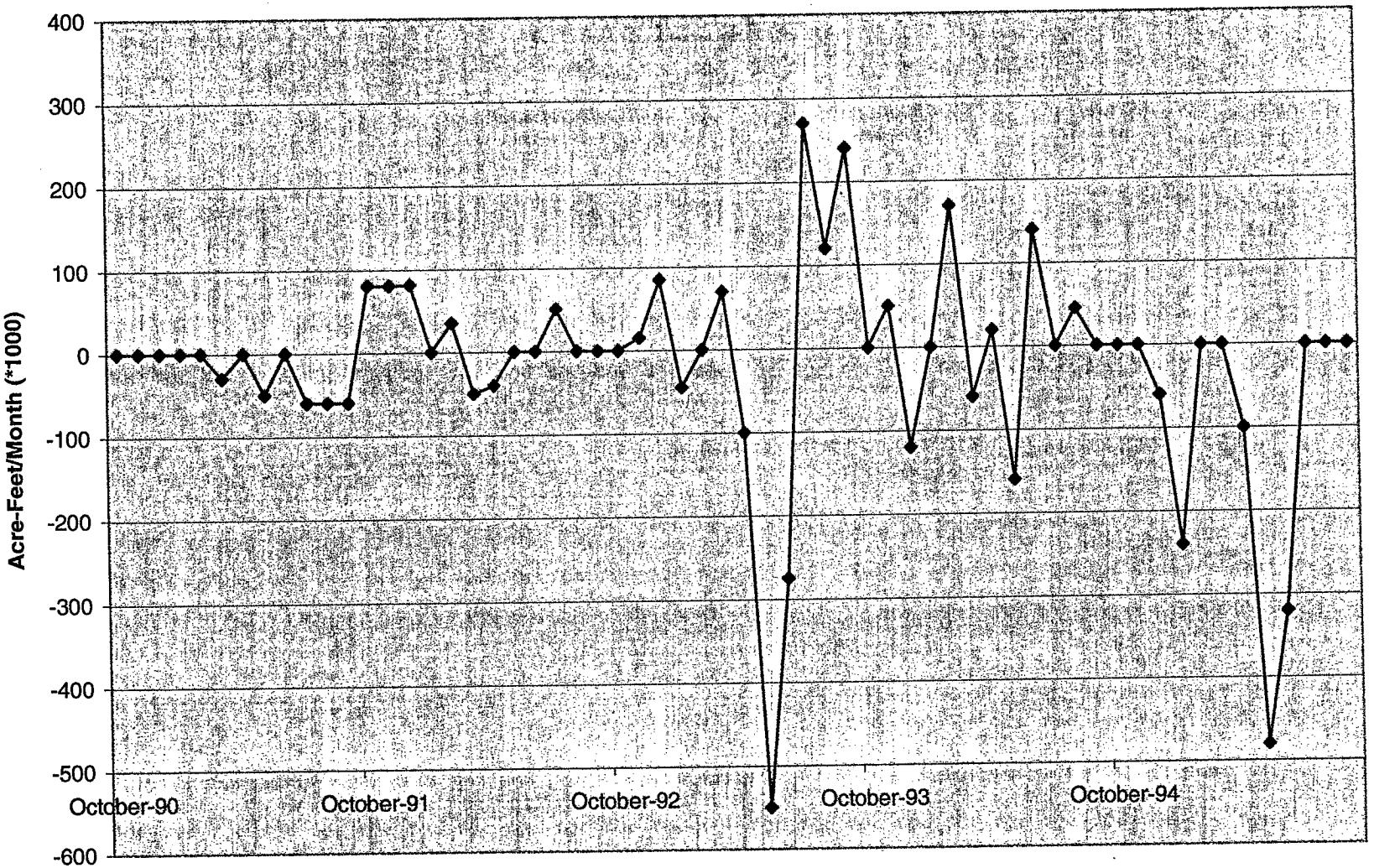
Summary

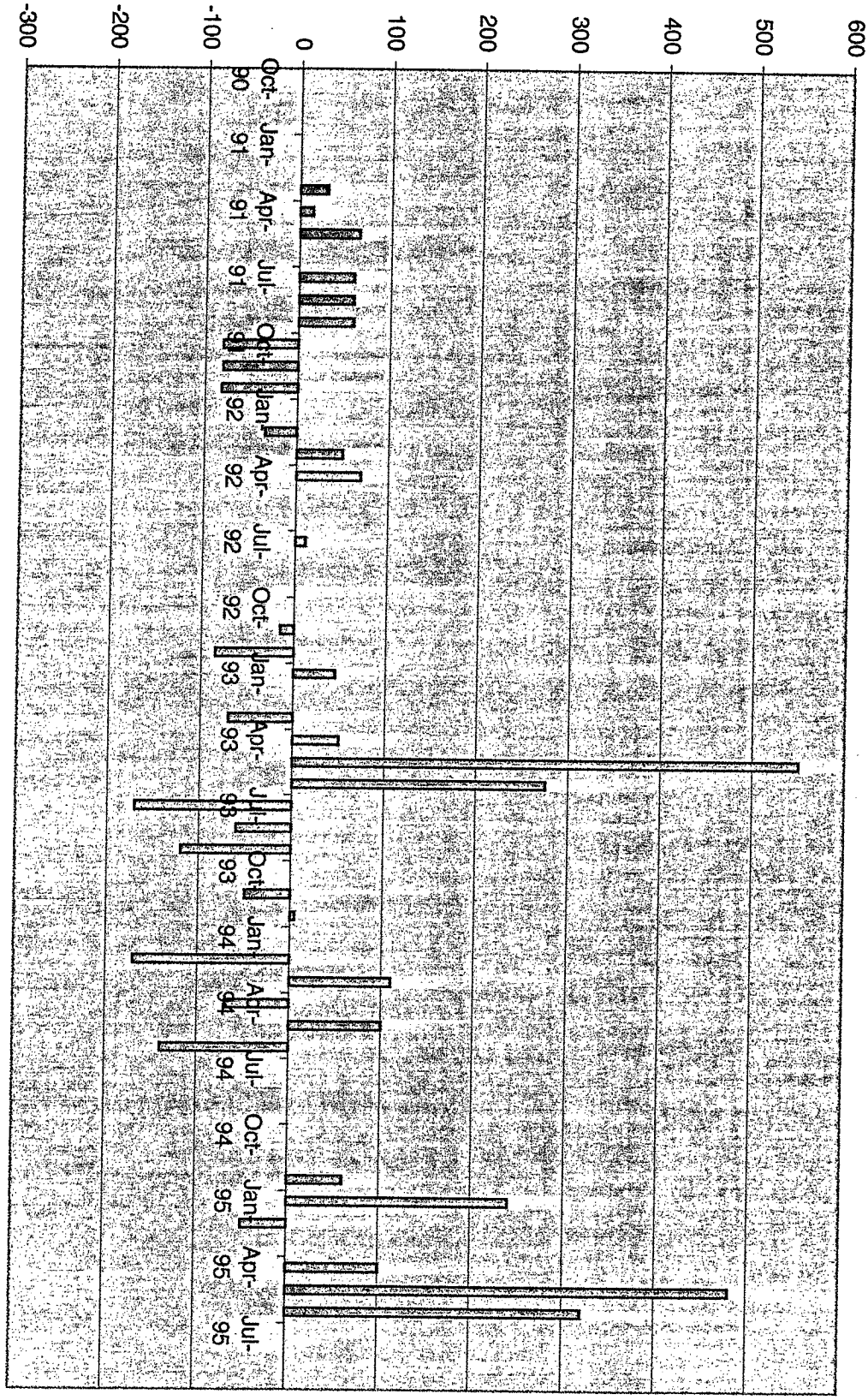
1991	1992	1993
250	420	280
85	0	140
0	0	0
0	0	0
0	0	0

EWA Assets
Game 5

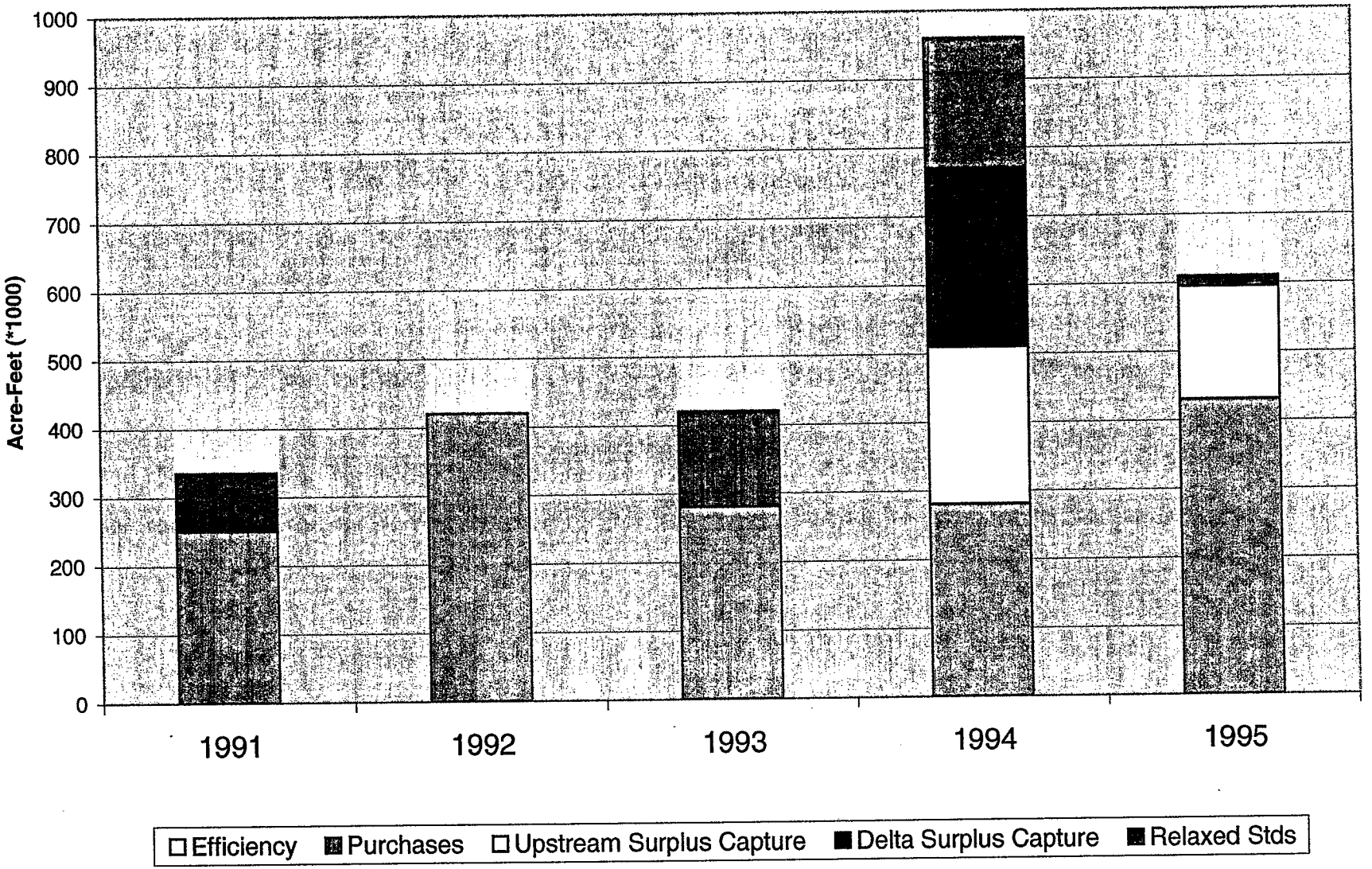


Change In Clifton Court/ Tracy Pumping
March 1999 EWA Game




Change in Delta Outflow
Acre-Feet/Month (*1000)
600
500
400
300
200
100
0
-100
-200
-300
Oct-90
Jan-91
Apr-91
Jul-91
Oct-91
Jan-92
Apr-92
Jul-92
Oct-92
Jan-93
Apr-93
Jul-93
Oct-93
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
Apr-95
Jul-95
Change in Delta Outflow

EIR Water Supplies
Game 5



GAME 5 *Water Year* 1991 Values in italics are calculated

		IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases														
San Joaquin River Market Releases														
Delta Cross Channel Closed?														
Change in CCFB/Tracy Diversions			*0*	*0*	*0*	*0*	*0*	*-30*	*-50*	*-50*	*0*	*-180*	*60*	*#REF!*
Carriage Water														
Change in Delta Outflow			*0*	*0*	*0*	*0*	*0*	*30*	*50*	*50*	*0*	*180*	*-60*	*#REF!*
South of Delta market "deliveries"														
MWD Shift Water to/from EWA														
Change Groundwater Storage			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage			*0*	*0*	*0*	*0*	*0*	*-30*	*-50*	*-50*	*0*	*-180*	*60*	*#REF!*
Increased exports due to AFRP Relaxation														
EWA share of increased Exports														
End of Month Values for EWA Accounts			0											
	$/af	IC	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		0												
Stored EWA Sacto		0										60	120	180
Stored EWA SJR						50	50	100	86	71	71	71	71	71
SemiTropic	200	0												
Kern	100	0												
EWA San Luis		0						(30)	(80)	(130)	(130)	(190)	(250)	(310)
Borrowed MWD		0												
Project Debt to EWA in SLR		0												
Increased deliveries														
Purchased														
Year Type: 1 for dry/critical. 0 otherwise			*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River														
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water														
Call spot water														
San Joaquin Trib														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*120*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water						50								
Call spot water														
Export Area														
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water								100						
Call spot water														
Cost of Options			*6.6*											
Leasing cost			*15*											
Cost of buying water options						3.75		13.5						
Cost of Groundwater Pumping			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA			*50*											
Interest														
Financial Balance		*0*	*28.4*	*28.4*	*28.4*	*24.65*	*24.65*	*11.15*	*11.15*	*11.15*	*11.15*	*11.15*	*11.15*	*11.15*

GAME 5 *Water 1992* Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*#REF!*	*0*	*-66*	*0*	*35*	*-50*	*-40*	*0*	*0*	*51*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*#REF!*	*0*	*66*	*0*	*-35*	*50*	*40*	*0*	*0*	*-51*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*#REF!*	*0*	*-66*	*0*	*35*	*-50*	*-40*	*0*	*0*	*51*	*0*	*0*
Increased exports due to AFRP Relaxation													
EWA share of increased Exports													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta													
Stored EWA Sacto		120	60	0	0	100	100	100	100		38	38	38
Stored EWA SJR		47	23	0	50	50	100	70	70		70	70	70
SemiTropic	200												
Kern	100												
EWA San Luis				(66)	(66)	(31)	(81)	(121)	(121)	(121)	(70)	(70)	(70)
Borrowed MWD													
Project Debt to EWA in SLR													
Increased deliveries													
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water						100							
San Joaquin Trib													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water					50								
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water						170							
Call spot water													
Cost of Options		*6.6*											
Leasing cost		*15*											
Cost of buying water options					3.75	37.95							
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.9*											
Financial Balance		*40.4356*	*40.4356*	*40.4356*	*36.6856*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*	*-1.26438*

GAME 5 Water 1993 Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*0*	*0*	*-50*	*0*	*0*	*100*	*60*	*120*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*15*	*85*	*-45*	*0*	*70*	*-100*	*-550*	*-275*	*270*	*120*	*240*
Carriage Water													
Change in Delta Outflow		*0*	*-15*	*-85*	*45*	*0*	*-70*	*50*	*550*	*275*	*-170*	*-60*	*-120*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*15*	*85*	*-45*	*0*	*70*	*-100*	*-550*	*-275*	*270*	*120*	*240*
Increased exports due to AFRP Relaxatior													
EWA share of increased Exports													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta								50	50	50	-50	-110	-230
Stored EWA Sacto		38	15	0	0	0	0	0	0	0	-50	-110	-230
Stored EWA SJR		70	70	70	70	70	120	120	120	120	0	0	0
SemiTropic	200												
Kern	100												
EWA San Luis		(70)	(55)	30	(15)	(15)	55	(45)	(595)	(870)	(600)	(480)	(240)
Borrowed MWD													
Project Debt to EWA in SLR													
increased deliveries													
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water					180								
Call spot water													
Cost of Options		*6.6*											
Leasing cost		*15*											
Cost of buying water options					24.3								
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.6*											
Financial Balance		*27.7518*	*27.7518*	*27.7518*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*	*3.45178*

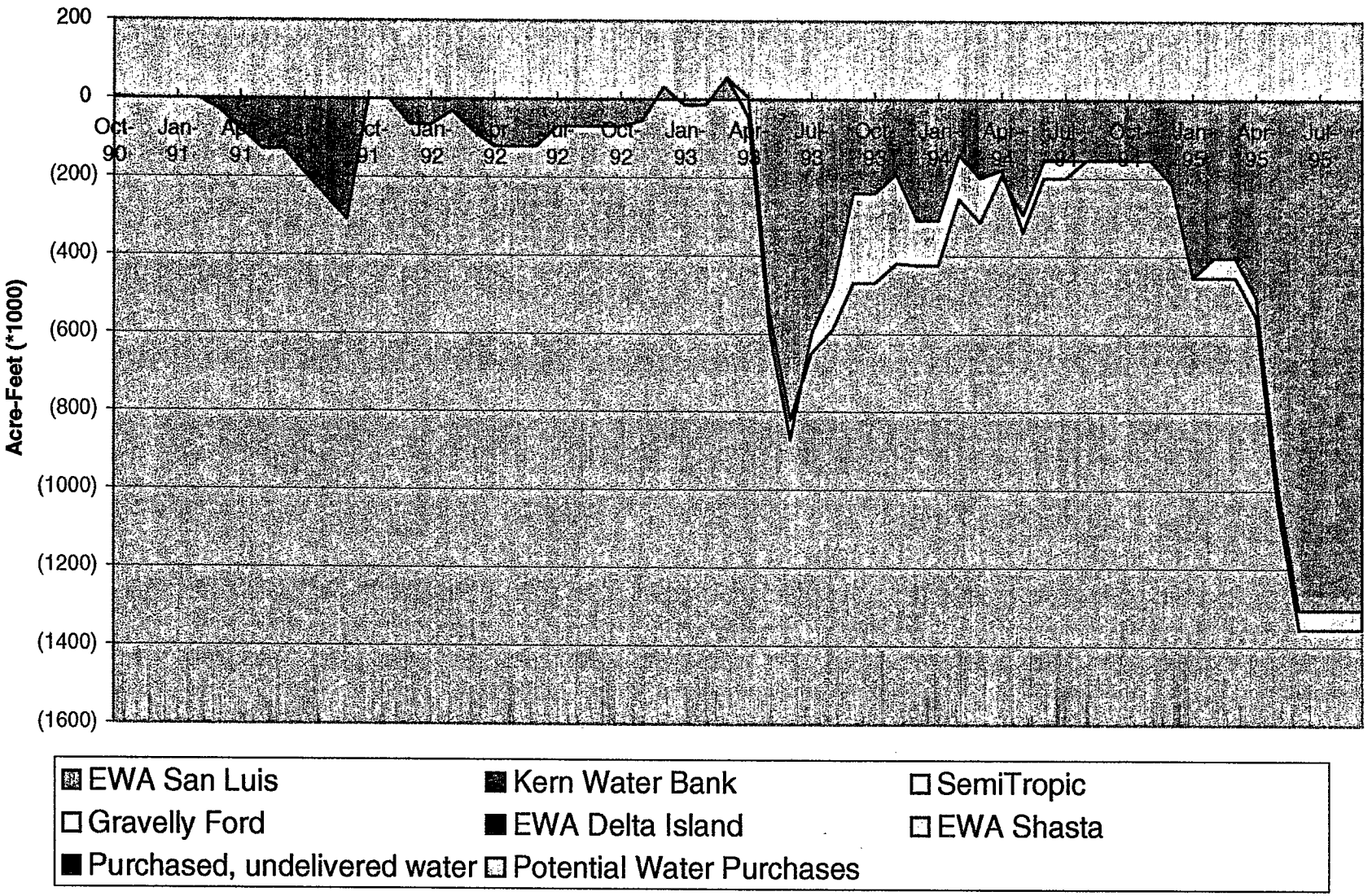
GAME 5 Water 1994 Values in italics are calculated

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*-115*	*0*	*0*	*0*	*-100*	*-60*	*0*	*0*	*45*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases							50	50					
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*50*	*-120*	*0*	*170*	*-60*	*20*	*-160*	*140*	*0*	*45*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*-50*	*5*	*0*	*-170*	*110*	*-70*	*100*	*-140*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*50*	*-120*	*0*	*170*	*-60*	*20*	*-160*	*140*	*0*	*45*	*0*
Increased exports due to AFRP Relaxatior													
EWA share of increased Exports													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		-230	-230	-115	-115	-115	-115	-15	45	45	45	0	0
Stored EWA Sacto		-230	-230	-115	-115	-115	-115	-115	-115	-115	-115	-115	-115
Stored EWA SJR		0	0	0	0	0	0	0	0	0	0	0	0
SemiTropic	200												
Kern	100												
EWA San Luis		(240)	(190)	(310)	(310)	(140)	(200)	(180)	(340)	(200)	(200)	(155)	(155)
Borrowed MWD													
Project Debt to EWA in SLR													
increased deliveries													
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*0*	*0*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water					100								
San Joaquin Tribs													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	*150*	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water					50								
Call spot water													
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*	*180*	*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water					30								
Call spot water													
Cost of Options		*6.6*											
Leasing cost		*15*											
Cost of buying water options					18.25								
Cost of Groundwater Pumping		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.5*											
Financial Balance		*32.3281*	*32.3281*	*32.3281*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*	*14.0781*

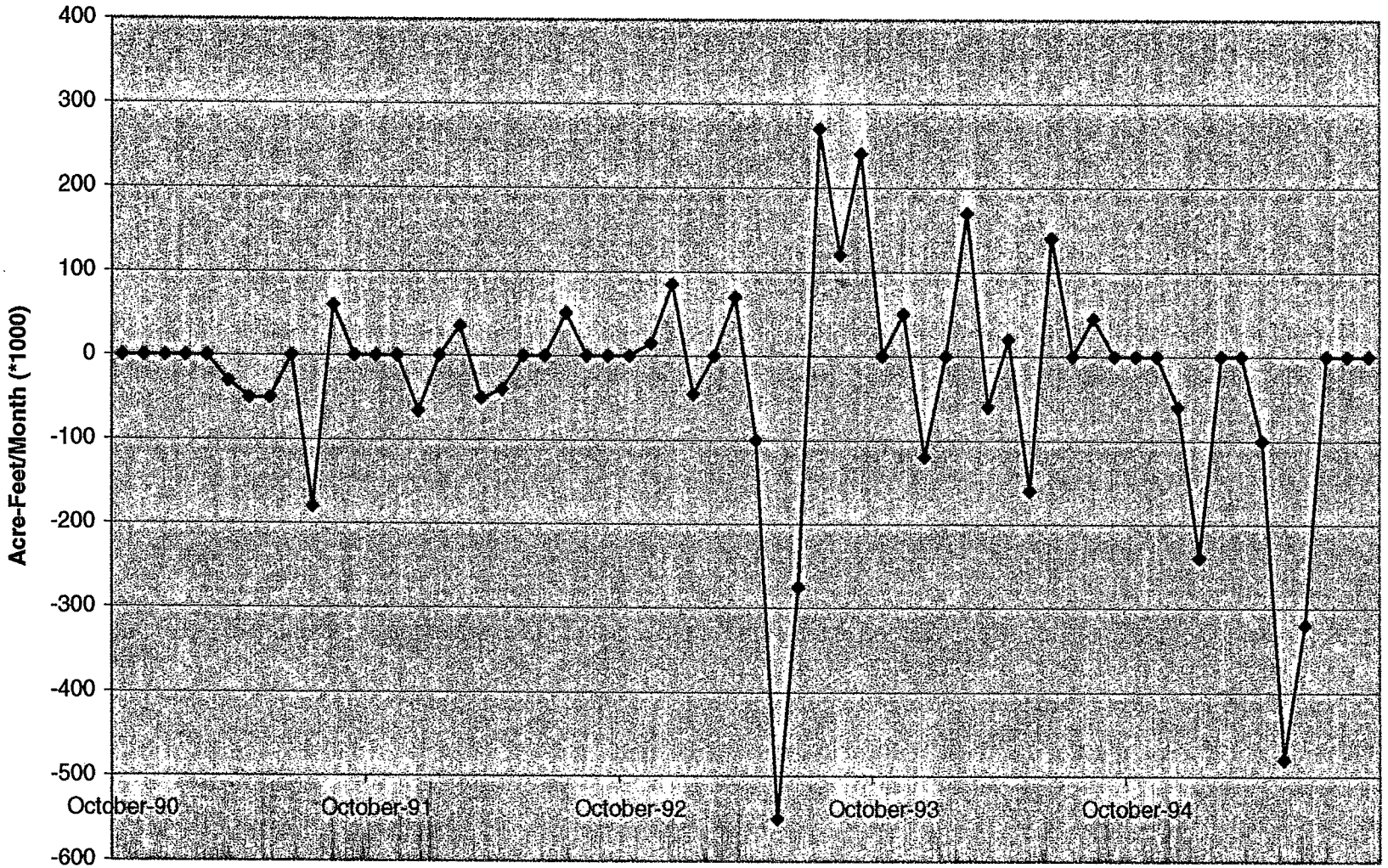
GAME 5 Water 1995 Values in italics are calculated

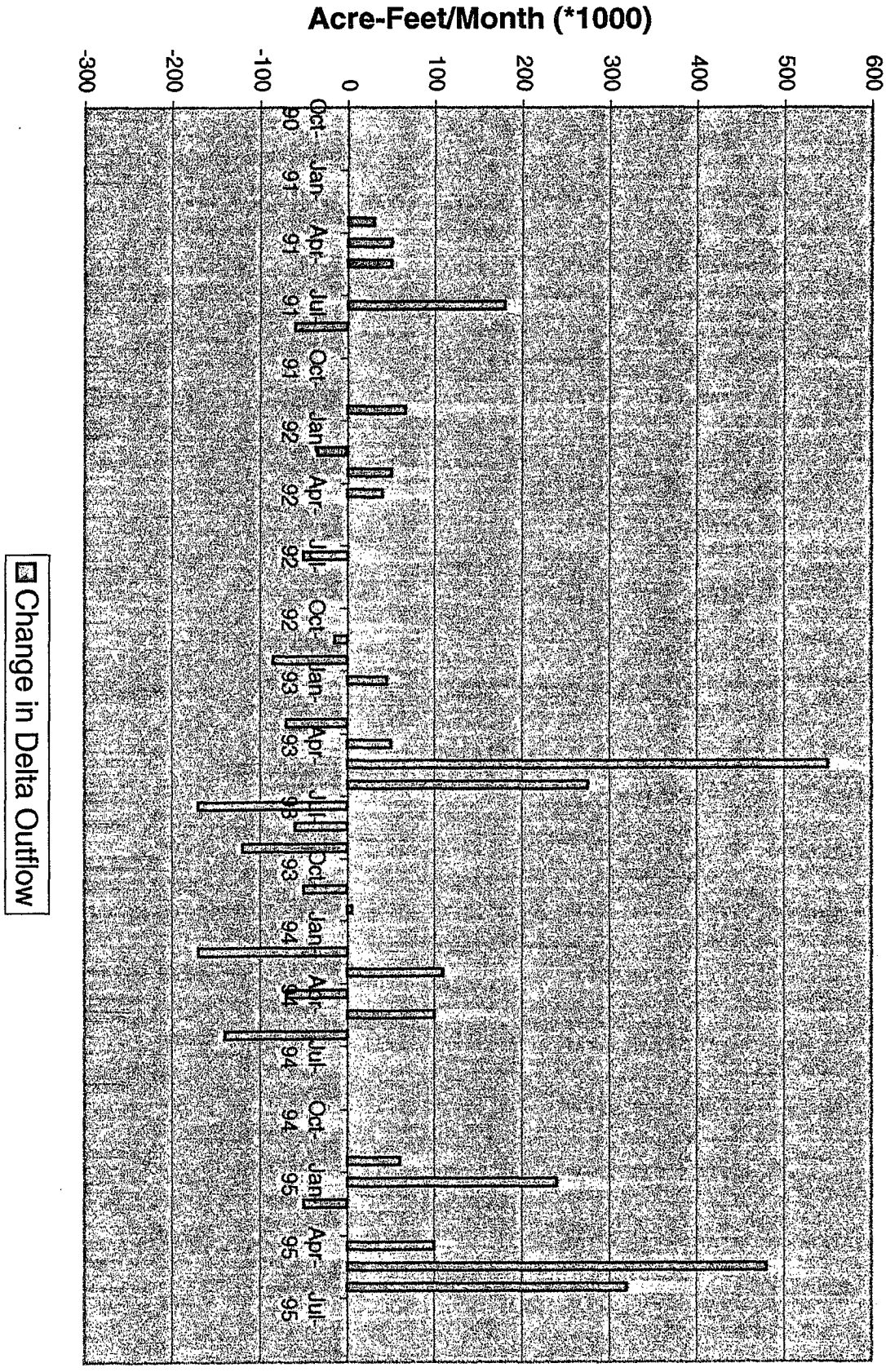
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change in Shasta Releases		*0*	*0*	*0*	*0*	*-50*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River Market Releases													
San Joaquin River Market Releases													
Delta Cross Channel Closed?													
Change in CCFB/Tracy Diversions		*0*	*0*	*-60*	*-240*	*0*	*0*	*-100*	*-480*	*-320*	*0*	*0*	*0*
Carriage Water													
Change in Delta Outflow		*0*	*0*	*60*	*240*	*-50*	*0*	*100*	*480*	*320*	*0*	*0*	*0*
South of Delta market "deliveries"													
MWD Shift Water to/from EWA													
Change Groundwater Storage		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Change in San Luis Storage		*0*	*0*	*-60*	*-240*	*0*	*0*	*-100*	*-480*	*-320*	*0*	*0*	*0*
Increased exports due to AFRP Relaxation													
EWA share of increased Exports													
End of Month Values for EWA Accounts													
	$/af	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
EWA Shasta		0	0	0	0	50	50	50	50	50	50	50	50
Stored EWA Sacto		-115	-115	-115	-115	0	0	0	0	0	0	0	150
Stored EWA SJR		0	0	0	0	0	50	50	50	50	50	50	100
SemiTropic	200												
Kern	100												
EWA San Luis		(155)	(155)	(215)	(455)	(455)	(455)	(555)	(1035)	(1355)	(1355)	(1355)	(1355)
Borrowed MWD													
Project Debt to EWA in SLR													
Increased deliveries													
Purchased													
Year Type: 1 for dry/critical. 0 otherwise		*1*	*1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sacramento River													
10 Year Lease	*115*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
10 Year Option	*250*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
One year Option	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*	*350*
Call 10 yr option water													
Call spot water													150
San Joaquin Trib													
10 Year Lease	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*120*	*150*	*150*	*150*	100	*140*	*140*	*130*	*100*	*100*	*100*	*100*	*100*
One year Option	*150*	*150*	*150*	*150*		*150*	*150*	*150*	*150*	*150*	*150*	*150*	*150*
Call 10 yr option water													
Call spot water													50
Export Area													
10 Year Lease	*50*	*50*	*50*	*50*	50	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
10 Year Option	*180*	*180*	*180*	*180*		*170*	*170*	*160*	*130*	*130*	*130*	*130*	*130*
One year Option	*250*	*250*	*250*	*250*		*250*	*250*	*250*	*250*	*250*	*250*	*250*	*250*
Call 10 yr option water					*30*								
Call spot water					*100*								
Cost of Options		*6.6*			*13*								*10*
Leasing cost		*15*											
Cost of buying water options													
Cost of Groundwater Pumping		*0*	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Payments to EWA		*50*											
Interest		*0.9*											
Financial Balance		*43.4102*	*43.4102*	*43.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*30.4102*	*20.4102*

EWA Assets



Change In Clifton Court/ Tracy Pumping
March 1999 EWA Game




Acre-Feet/Month (*1000)
600
500
400
300
200
100
0
-100
-200
-300
Oct-90
Jan-91
Apr-91
Jul-91
Oct-91
Jan-92
Apr-92
Jul-92
Oct-92
Jan-93
Apr-93
Jul-93
Oct-93
Jan-94
Apr-94
Jul-94
Oct-94
Jan-95
Apr-95
Jul-95
Change in Delta Outflow
Change in Delta Outflow

Game 5: 1991 Water User Baseline – Day 1, Stage 1

- Beginning of series – learning exercise
- Other baseline without b2
- Game to start with – get a good evaluation – focus on all attributes
- Launch into other games after this experience.
- Water users would still like game with more flex-relaxations.
- Features – limited Banks expansion, JPOD, E/I variances (for EWA), lift InDelta AFRP (for water supply), demand shift option by borrowing from San Luis.
- Decision to stay at $40 million account and borrow extra needed.

October	No Actions.
November	
December	
January	Exports 3960, outflow 4748, E/I 44%, X2 86.
February	Export 981, outlfow 12000, E/I 7%, X2 78.5. No pumping of extra flow because X2 near coming limit in mid month.
March	Exports 11600, outflow 25000, E/I 32%, X2 70. Relax first week E/I and cut exports in last two weeks to 5kcfs. Cost of 75TAF net. (85 gained and 160 hit). Buy 100 TAF on exports.
April	Export 6499, outflow 11600, E/I 33%, X2 72.5. Project would require flows from SJ of 3200 cfs and can export up to 3200 cfs until end of the month when outflow limit applies. Accept 50 TAF cost of keeping exports at 1500 for last two weeks, but may have been able to adjust upstream reservoir releases in the first two weeks to make up some of this water. Released 500 cfs from SJ in first two week at a cost of 14 TAF.
May	Export 3900, outflow 5300, E/I 34%, X2 81. Reduce exports to 1500 in first two weeks, ramp exports up in last two weeks to 3200 cfs, ramp flows from 3200 in first two weeks down to 1500 cfs at end of month. Cost of reduced exports 50 TAF. Cost of 15 TAF for extra SJ flow.
June	
July	Cut exports to 1500 from July through September and back up 100 TAF of water into Folsom – by borrowing 100 TAF of San Luis storage.
August	

September	
Yearly totals	

Game 5: 1992 Water User Baseline – Day 1, Stage 1

October	No actions except releasing 180 TAF of water to the American River through the fall and moving it to San Luis. Move 71 TAF from SJ to San Luis, thus increase exports about 1300 cfs over period. Carriage water balanced between the credits from the summer and the releases in the fall; note that the flow differences we did not consider might be important. Released the water equally over three months and increased exports to cover debt in San Luis.
November	
December	
January	Exports 7300, outflow 5854, E/I 56, X2 84.7. DCC closed. Salmon began appearing. No action.
February	Exports 8000, outflow 31000, E/I 22%, X2 71. Cut exports to 5000 in last two weeks. Buy 180 TAF SOD options. Buy SR options 100 TAF at 15 million.
March	Exports 8200, outflow 15138, E/I 35%, X2 72. Cut exports to 5000 in first two weeks.
April	Exports 3100, outflow 10 147, E/I 21 %, X2 75. Vamp limits of 1500 in last two weeks. Add 1000 cfs for first two weeks in SJ (30TAF).
May	Export 530, outflow 5700, E/I 6%, X2 80. No Actions.
June	Deliver 62 TAF (50 delivered, 12 carriage water) from Shasta in last half of July.. Carryover 70 TAF into next year .
July	32 released 6 carriage water from Sac
August	
September	
Yearly totals	

Game 5: 1993 Water User Baseline - Day 1, Stage 1

October	32 TAF released 6 carriage water from Sac relaxed E/I in Dec picked up 70 TAF in San Luis to cancel our debt.
November	
December	
January	Export 12,700, outflow 56471, E/I 20%, X2.66. 225 TAF cost of reducing exports for splittail.
February	Export 12300, outflow 49500, E/I 21%, X2 61. No action except limit 25 of splittail, which did not curtail.
March	Relaxed E/I at end of month gained 75 TAF.
April	Cut exports to VAMP level starting the second week at 1500; also move up VAMP flows one week. Cost of 150 TAF. 50 TAF to San Luis from export area lease purchase.
May	Exports 8300, outflow 26600, e/I 22%, X2 64.5. continued cost of VAMP of 50 taf for first week in May keeping exports at 1500 cfs. Continuing export restrictions through May by ramping at the Vernalis flow level. Using 3000 for last 3 weeks. Cost of additional 500 TAF. Total for month of 550 TAF.
June	Exports 12400, outflow 19000, E/I 35%, X2 68. Ramp up from 3000, to 5000, to 7000, then relaxed E/I in last week. Cost of 275 TAF.
July	Exports 5500, outflow 8000, E/I 30%, X2, 75.5. Shift debt to Shasta and begin using SJ water. Increase 2000 cfs release for month from Shasta, paid in part by 50 TAF EWA in Shasta, the rest is debt. 4000 cfs from Sacto side and 2000 cfs from SJ side to move debt upstream and help keep water in San Luis. 120 from SJ, 50 from Shasta, new debt of 50 TAF in Shasta and 50 TAF in Oroville.
August	Export 12700, outflow 4000, E/I 64%, X2 83.4. Moved 360 TAF from Sacto reservoirs to San Luis - borrowed EWA shifted upstream. Could have moved more say from Folsom.
September	
Yearly totals	

Game 5: 1994 Water User Baseline - Day 1, Stage 1

October	Oct. Exports 11,284, outflow 7300, E/I 56% X2 83. Relax E/I in November gains 50 TAF.
November	Cross channel gates closed in latter November. December reduction of exports to 8000 cfs to protect spring run. Relax E/I in first week, then restrict exports last week. Cost of 120 TAF for restricting exports the last three weeks of month.
December	
January	Exports of 9850, outflow 9400, E/I 52, X2 79%. Debt falling as SL storage is within 310 of top.
February	Exports 5900, outflow 26000, E/I 19, X2 70. Nearly filled SL, thus debt in San Luis is reduced to that amount.
March	Exports 5800, outflow 10400, E/I 33, X2 74. Restrict pumping because of winter run 191 index. Plus release 2000 cfs from SJ last two weeks. Keep exports to 4000 at a cost of 150 TAF, but debt limited to 200 TAF because SL was within 200 TAF of filling. Boosted X2 slightly.
April	Exports 3800, outflow 7745, E/I 28, X2 = 88. Transferred 80 TAF to San Luis from our water options. Paid off 100 TAF of debt in Shasta. Reduce exports to 4000 first two weeks, 1500 cfs second two weeks. Cost of 60 TAF.
May	Exports 3496, outflow 6300, E/I 30%, X2 81. High smelt salvage (0.5-1 per AF), moderate chinook. Limit exports to 1500 cfs. Took a hit in San Luis of 160 TAF, backed up 60 TAF into Shasta.
June	Exports 6300, outflow 6900, E/I 35%, X2 81 No change first two weeks because protection needed for continuing high density of smelt. Relaxed E/I last two weeks provide 140TAF of EWA water to San Luis. Question the extra release of water from Keswick that allowed us to pick up this water.
July	Exports 13000, outflow 4000, E/I 60, X2 85.
August	No actions except moving 45TAF from Shasta to pay some debt in San Luis.
September	
Yearly totals	

Game 5: 1995 Water User Baseline – Day 1, Stage 1

October	
November	
December	Relax E/I in December to pick up 15 TAF of water for EWA.. Late in December spring run salmon are showing in salvage. Constrain pumping to 8000 in last two weeks. Cost of 75TAF.
January	Constrain pumping to 8000 entire month. Chinook salmon abundance is moderate. Cost of 240 TAF.
February	No actions.
March	No actions.
April	VAMP of 3000 export limit with high SJ flows for last two weeks. San Joaquin salmon outmigrating without benefit of HOR barrier. Cost of 280TAF. Historical exports were too low to accurately estimate density.
May	VAMP of 3000 export. Decreasing exports but looking for benefit at CVP, where highest densities occurred. Cost of 480 TAF.
June	Carry splittail trigger through June. With 3000 cfs for first two weeks; and splittail limit the last two weeks. Cost of 320 TAF.
July	No change
August	Buy 200 TAF of water to deliver in 96.
September	
Yearly totals	

GAME 5 – BIOLOGICAL

"Day One, Stage I"

Intent of this record is to capture only the biological logic of this game; decision forks, rationale, etc. See other notes for non-biological matters.

Back ground: Very important game. Need a good, intensive biological evaluation of this game. Focus on as many biological attributes as possible.

October 1990 – Water Year 1991

- *Very few salmon salvaged.*
- *There were no in-Delta AFRP actions in October.*
- *No need for fish actions.*

November / December 90

- *Skip these months; no need for fish actions.*
- *DA 8 is not in Russ's model- how to handle? Not in Russ' model; is info gathering action, not a protective action, was not considered in earlier games. Therefore, is not an issue in this game.*

January 1991

- *Small number of Delta smelt, splittail and steelhead in project salvage (<100 fish/TAF).*
- *FMWT = 363 (mod to low)*
- *Have not taken actions in other games.*
- *No fish actions taken.*

February 91

- *Starting to see more adult DS at facilities*
- *Decided not to pump the small storm, as in prior games.*
- *No fish actions taken, other than to not pump the storm..*

March 91

- *Have relaxed E/I in prior games for one week.*
- *DS are concentrated at 89 (mid-Sherman Island)*
- *Started to see CS at SWP 3/1; Started to see CS at CVP 3/15*
- *Taking a few DS through March; Some adult ST at CVP*
- *Decision: Relax first week, no change in second week, 5,000 limit in 3rd and 4th weeks*
- *Reason: With 2 weeks of monitoring foresight, monitoring showed fish in week 2, therefore backed off.*

April 91

- *DS location?; they earlier were 10 km upstream.*

- *CS exceeded 100/TAF at SWP; show up on 4/1*
- *Decision: Cut exports to 1500 cfs during the 3rd and 4th weeks to be consistent with the VAMP and CS are showing up; this is definitely a salmon action, not DS*
- *Could eliminate costs of VAMP export requirements and make exports supportable throughout the VAMP period by tweaking the upstream AFRP actions. We need to consult with Castleberry et al on how to prioritize upstream actions against delta actions and other EWA abilities/obligations.*

May 91

- *Keep exports at VAMP level in first two week of May to protect salmon. Salmon declined in latter part of month. If you have both smelt and salmon then you ramp flow and exports. Since only salmon then flow is target.*
- *Ramp SJ flows on end of May to average of 2200 for outmigrating smolts set exports to 2200.*

July-September 91

- *Supply water out of San Luis in place of transfer out of American in order to delay transfer release into Salmon spawning season in September-October. Possible side benefit to striped bass in July in fashion similar to delta action 7.*

October 91 (1992 water year)

- *Releases would do most good later than October but assumed that we would release water equally from Oct – Dec to help American salmon. Could trade some of this flow to other rivers*

January 1992

Sacramento River salmon showing up close DCC at beginning of January

February 1992

Elusion that there were no fish first week, no historic pumping in record.

Adult Delta smelt and steelhead are showing in salvage

Second week all fish show up in salvage

May have been a mistake to relax E/I first week in past.

Limit pumping 5,000 cfs last two weeks

2nd week salvage coming up slowly , therefore no change

Total hit 135 TAF hit.

EWA starting to run in hole, buy more options

March 1992

Large salvage of salmon 100 in first 2 weeks at both SWP/CVP

For salmon and steelhead keep export rates of 5,000 cfs first two weeks in March, 100TAF cost

For improvement salmon and steelhead while migration through delta and at the pumps.

No change in last two weeks change to smolt size fish and densities drop from 100

April 1992

No VAMP flows because of drought.

3,200 cfs USBR and USFWS released from new Melones and can pickup in exports

Impose VAMP export requirements

1,500 cfs export limit for last three weeks, 40tTAF

Add 1,000 cfs first 2 weeks for San Joaquin salmon

May 92

Declining numbers of salmon through out the month, splittail and smelt

Not much exports so we can not do much for fish.

Can carryover EWA debt because it has now collateral.

DWRSIM runs to flow or X2 requirement. Least water cost to win.

June/July/Aug/September 92

Water user are willing to carryover 70 TAF of debt in San Luis

Move 62 TAF from Sacramento Valley to 50 TAF in San Luis 12TAF carriage water in Mid-July

End of 92 and Start of 1993

38 Sacramento

70 San Joaquin

71 dept in San Luis

$28 M after buying 100 TAF options

Oct-Dec 92

Move all Sacramento and San Joaquin stored water to San Luis, need be careful that we don't waste or put unnecessary pulses. Reservoirs low so just move San Joaquin water 70-15 carriage 45 against debt, still owe 26

Could use releases of upstream water to follow on behind storm to smooth out hydrographs for fish

No fish in first three weeks, gained 70 TAF in black 46 TAF

January 93

Salmon showing last part of December and first of January.

Set splittail trigger to 25 for all month, cost 225 TAF, triggered for 19 days. Adult delta smelt also high. Resulted cutting delta smelt in half also.

Purchase 180TAF options in export areas. Would actually would pump even with the Roe Island X2 requirement

February 93

Lots of steelhead. Splittail 50-100 but declining. Adult splittail at end in drought.

Test splittail at 25. Spittail declined below trigger so didn't get much.

March 93

Spittail and Smelt declining

Relax E/I last week Gained 25TAF

Go with VAMP export requirements and drop to 1,500 starting second week in April.

Move VAMP flows up one week. Cost 90 TAF, 20 TAF in debt

April-June 93

Salmon, splittail, and smelt increasing late in April – remain high through third week in June. Need to control exports from second week in April through third week in June.

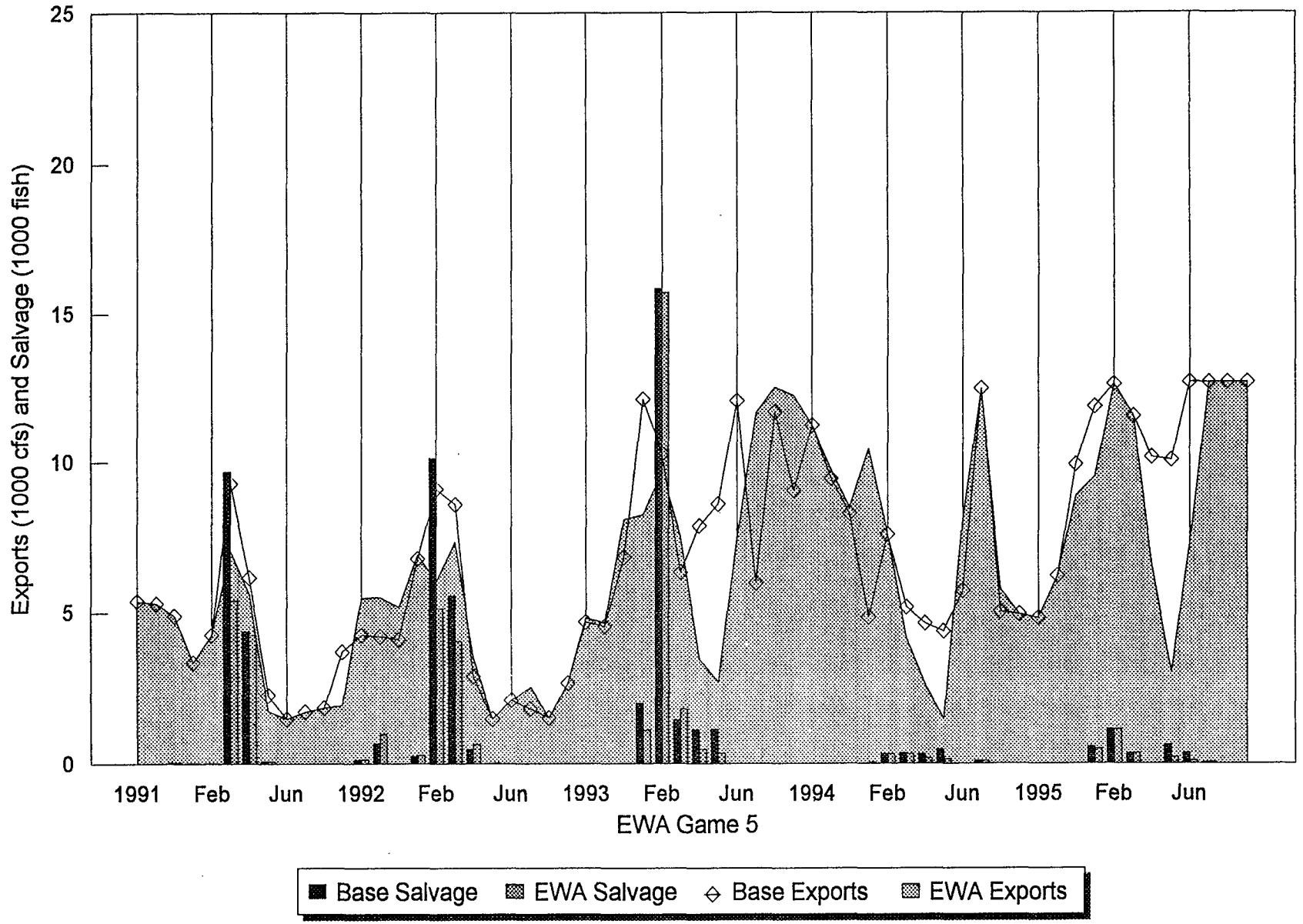
NOTES:

1) Biological Benefits Assessment - Jim White
   a) Timing of fish entering Delta - use of trawling data; Chipps Island, Sacramento, and Mossdale surveys
   b) Upstream benefits should be considered.
   c) Temperature effects of flow changes - river temperature models
   d) Benefits of Streamflow augmentation
   e) Goal: move toward wet year circumstances with dry year assets.
2) Striped Bass - Pete Chadwick
   a) Evaluated games 1, 2, and 4.
   b) Results emailed.
   c) Mixture of adverse and positive effects
   d) Not as much negative effects as anticipated - less entrainment of striped bass primarily because of delta smelt actions.
   e) Differences in games 4 and 5 difficult to determine - basis for comparison different.
3) Water Supply - B.J. Miller
   a) Looking at effects on state and federal deliveries
   b) Looking at effects on West Side.
   c) Difference between deliveries and demands.
   d) Trying to make up shortfall of 200 TAF each for state and federal contractors. Slightly more is needed for CVP.
   e) Need water to meet demands in 70% percent of years.
   f) Trying to develop a new CVP demand curve.
   g) Schuster is trying to develop a new SWP demand curve.
   h) Will put these together to define what WS people mean by 400 TAF need.
4) Comments on gaming:
   a) Demands affect model drastically.
   b) Game 5 would work much better if 1000 cfs of the new expanded Banks capacity were allocated to EWA - this would have allowed the game to work and balance out. EWA needs some of new capacity and facilities on Day 1 Stage 1.

c) We could have done more to ease debt carried in reservoirs in Game 5.
d) Carryover debt from year to year is an important tool of EWA, especially in Game 5.
e) The way we worked the debt no one was impacted. EWA adjusts hydrology and exports by taking on risk and having collateral to pay if necessary.

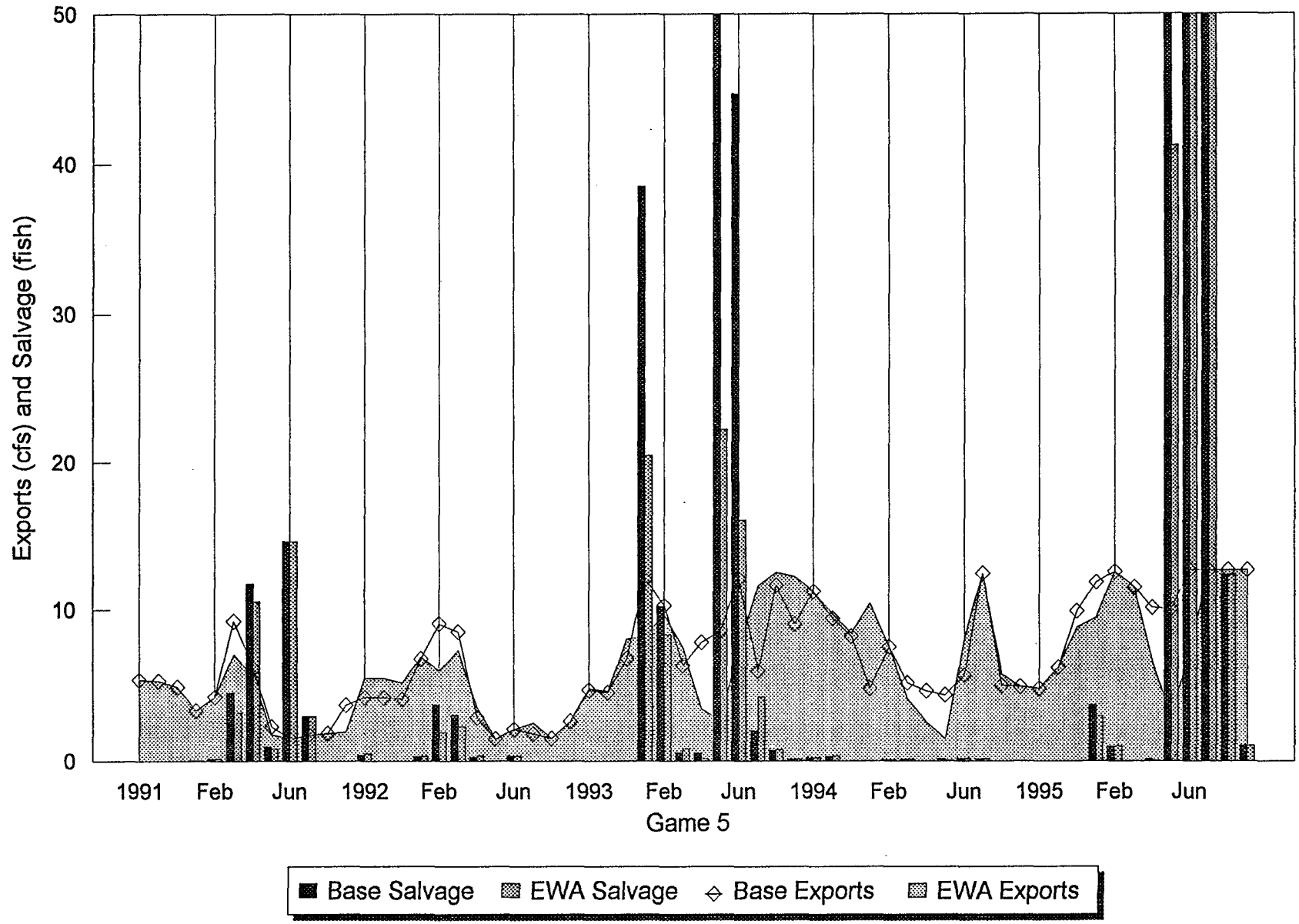
Steelhead Benefits from EWA Game 5

Using SWP Salvage Densities



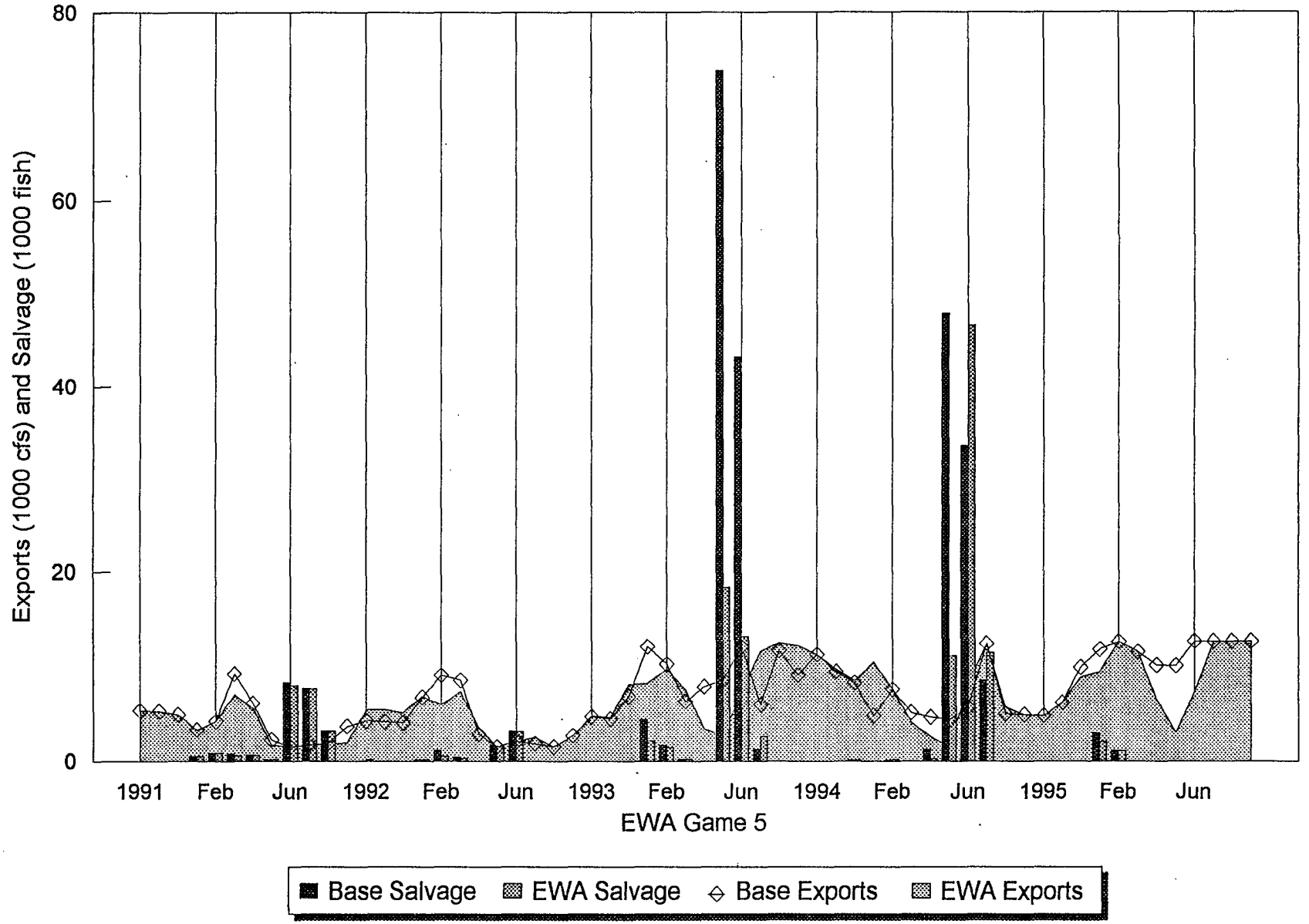
Splittail Benefits from EWA Game 5

Using SWP Salvage Densities



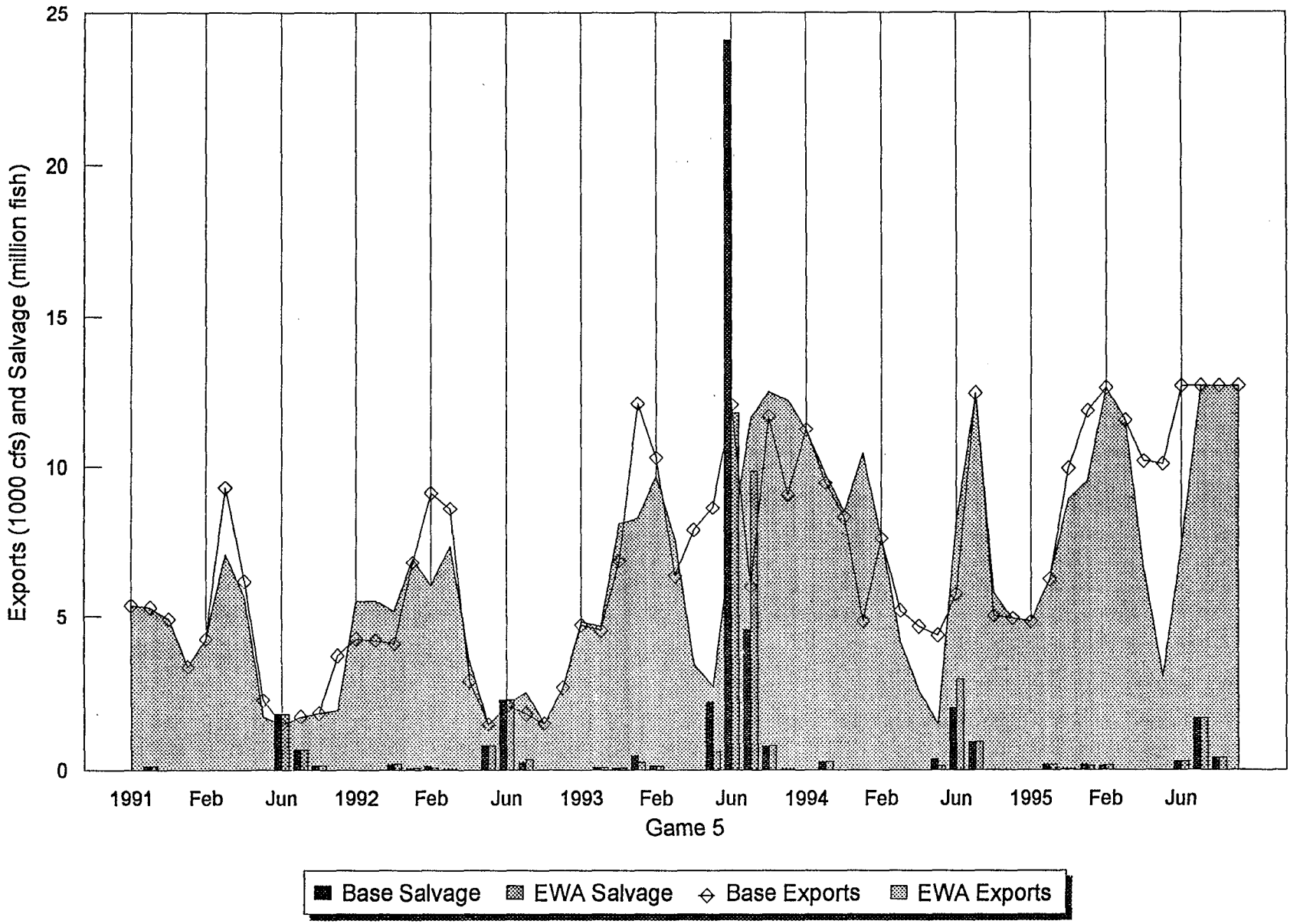
Delta Smelt Benefits from EWA Game 5

Using SWP Salvage Densities



Striped Bass Benefits from EWA Game 5

Using SWP Salvage Densities



Issues

Gaming Issues

Game 1 Issues

1. Should conduct a gaming exercise with a base run w/o in-delta AFRP.
2. Need to consider water quality impacts as we progress through game.
3. Determine cost of moving and purchasing water as we go.
4. Should considering closing DCC only when salvage is increasing or high.
5. Input monthly distribution of ET in the Delta
6. Need to consider water cost of closing DCC
7. San Joaquin attraction flows
8. Tax on EWA releases from Shasta? Carriage loss? 20% combination of carriage and conveyance loss? As long as we are not exporting it, it is not an issue. Effect on Shasta cold-water pool.
9. Exact accounting of EC from G model.
10. Concern about chopping off first flow peaks of year.
11. Concern about pulling X2 upstream with delta smelt if we take first February small flush in 1991 and put into EWA SL and allow X2 to move upstream.
12. Is the harm that might befall ds, sig relative to future benefits of EWA water in such a dry year as 1991.
13. Consider proportion of hatchery salmon in the salvage?
14. CCF screen not in place for this game.
15. Using DW Bacon as a forebay for project diversions. Concern about using this island as a wheeling facility. Power costs? Other costs? Assume that DW is owned and operated by projects.
16. If EWA cuts diversions and lower E/I, can projects DW island divert to storage because they have screens to protect salmon? If we let it go onto Webb, then that would EWA water. But that would be an additional impact. Also non-screen issues from exporting to Webb.
17. The value of individual fish increases as the population is lower.
18. Difference in screen efficiency and location of the intakes are important factors when making decisions on using Webb, Bacon, or CCF.
19. Indirect effects (benefits) of export curtailment.
20. Benefit of increasing SJ flows in preVAMP conditions/period.
21. Should we consider putting in HOR before VAMP if we reduce exports?

22. TOC if DW islands water remained unused for long period. Could recycle water through island to keep it fresher, but would have pumping effects. Just keep track of this facility's use pattern; may not be a problem. Under surplus conditions no problem with recirculating; there would be a problem when not in surplus.

23. Kern priority in dry years. Not sure how they can operate the project. 400+ TAF capacity.

24. Separating Delta from upstream conditions?

25. Increasing pumping may cause increased salvage that triggers restrictions earlier.

26. Releases from project island when stored water TOC is higher than ambient.

27. Increase in concentration of TOC during storage – absorbtion, resuspension

28. In Delta storage quality issues: a) foregone ag use on islands (salt and TOC); b) irrigation season benefits vs single discharge of stored water; and c) evaporation effects.

29. Fate of released water. % increase in TOC at CCWD and CCF at Tracy Intakes.

30. Do not use these rules for Stage 1 operation until we have taken in a broader perspective. Do not worry about the details at this time.

31. % of fish protected with DCC.

32. Appears to be a frequent need for San Joaquin flows that puts demands on SJ storage.

33. Might consider quantity and price of water that varies by year type – last year type.

34. If EWA triggers a change in ROE X2 requirment, how would we resolve this?

35. Using log scale of fish densities is deceptive.

36. Careful with Sac flow fluctuations in August/September.

37. Daily model indicates opportunities to take water when the monthly model indicates otherwise.

38. Using DW in two ways – forerunner of new screening facility – storing or passing through. Mixing two types at same time. Use intake at Bacon most of time, except for cost factor.

39. If projects go above their baseline because of previous month cutbacks by env action, but stay below constraints, does the water go to EWA or projects? And conversely. Who pays for pumping costs? Real world has no baseline. Evaluate against real world accounting. Cost of projects would be known by end of period.

40. Interruptible supplies as a black hole?

41. To the extent that we affect move X2 downstream with env actions, how do we account for the extra water projects can pump? Similar to Roe Island issue (inverse).

42. Question benefit of reverse carriage water when backing up water into NOD storage.

43. July exports are function of June exports, if EWA reduce June exports than we would not penalize July exports. Make sure we allow this relaxation.

Game 2 Issues

44. Both south Delta pumping plants would be screened at year 7.

45. May have overestimated groundwater resources available in dry years. May mess up the baseline. Kern has unknown potential; depends on how much local users demand; possible 0-30TAF. Model uses 30TAF for WS portion. EWA has 10TAF per month available. This is conservative. 20TAF is safe for Stage 1 for Kern.

46. Baseline for Study 834 (game 1) is not realistic from water users perspective. Need a run of Accord + Upstream AFRP as the base, or basis of comparison for water users. EWA could also be used for portions of the 834 base.

47. Using 91-95 always may bias our view of the EWA.

48. How to adjust salvage numbers using new screens at south Delta pumping plants; especially given reduction in predation in CCF.

49. EWA water on Bacon could be useful for WQ when Delta channel quality is poor in the fall.

50. WQ benefited from Accord.

51. Could borrow from each other – EWA could borrow Webb storage or exchange Webb and back into Shasta. EWA can relax E/I when WS can not. Or stick to defined roles for each island.

52. Why constrain exports if new screens are in place? R: Because of indirect effects.

53. Monthly export salvage losses limit our ability to adjust daily operations when using daily model.

54. Is salvage a good surrogate for real-time monitoring?

55. Depending on where options are available would determine which species we would protect.

56. Difficult to speculate location of smelt in summer after doing many things over spring.

57. Where to store water called upon? If you buy Yuba water they will want to release it in the summer. Could Yuba keep it in summer? Water purchases real?

58. Is pumping onto Webb constrained by E/I?

59. Do storage islands need a pipe to pumps? WQ problem.

60. Need to think about in-lieu features for environment as well as for water supply.

61. Option to sell EWA water to water supply needs pricing guidelines. Need to work out pricing guidelines. Drought bank situations. E/I generated water should not cost $300/AF, but may be worth market value.

62. What negotiating points need development; tying these down will be one of the fruits of our gaming effort. What we do for all pieces of the picture such as demand reductions needs to be presented. Look for ties to rest of CALFED program to provide an integrated program.

63. Advantages of keeping EWA water in San Luis by raising low-point.

64. Sharing facilities and relaxation standards for both WS and EWA would make the system more efficient.

65. Need to look at historical and baseline conditions when we are looking at results.

66. If EWA actions generate (reduce) power benefits who gets that revenue (cost)?

67. CVP Tracy could be used to pump water to SWP San Luis.

68. Impacts would still occur if we go back to prescriptive standards, thus we still need to consider them.

69. Advantage of pumping at Webb or Bacon over CCF or Tracy given all have same screen protection? (Better to pump from main channels?)

70. Water quality changes on the DW islands during spring and summer. Webb could be looked at with different intents for the water – outflow versus export.

71. Moving water from upstream options to Delta in summer may affect upstream habitat conditions.

72. Options were not intended to be exercised every year.

73. Fish versus WQ conflict in July. Fish want to hold new exports to August, but more benefit to WQ if released earlier in the summer. Algae and nutrients are water quality problems, thus release it earlier the better.

74. Recirculate Webb to help WQ.

75. Can't short projects without collateral; question whether money is adequate collateral and whether we could buy on spot market.

Game 3 Issues

76. E/I ratio is average standard, thus what does it mean to relax E/I over short period.

77. If Credits or options are used to enhance outflow, then can WS take extra water onto DW islands?

78. Demands from projects affect on deliveries and San Luis storage and DW island storage. Demand levels are different between daily and monthly models. Russ used more than

historic; Russ's are less than George's demands. The patterns of demands are just as important as storage considerations.

79. Effect of San Joaquin spills from Friant on export demands. Are deliveries from the Delta Mendota Pool accounted for in the deliveries in DWRSIM? GW and Interruptible may explain the higher deliveries in DWRSIM.
80. Clear ID of demands by year type is needed as what we use has a large impact on operations that we are unable to factor into the gaming, which affects our decisions on exports and deliveries.
81. Winter exports have screens to protect yearling salmon, splittail, and adult smelt? Or are indirect effects sufficiently important to limit exports to protect these fish?
82. Backing up EWA water into reservoirs could be expanded if AFRP flows could be relaxed.
83. Could use reverse demand shifting between EWA and projects.
84. Increasing future demands and infrastructure will erode away the capabilities of the EWA.
85. Account has no access to first 15,000 cfs.
86. How much San Luis debt can be carried through summer. Rule is no harm – as long as no impact on deliveries we can carry debt in San Luis.

Game 4 Issues

87. EWA takes a lot of GW and SJ water available for transfers.
88. Sharing of expanded Banks pumping.
89. Conveyance water losses on San Joaquin.
90. Beginning VAMP a week early has an impact that EWA does not have to pay back.
91. Demand effects EWA, but also upstream AFRP requirements also put in extra inflow over historical – about 5,000 cfs extra released.

Game 5 Issues

92. Scale of baseline differences is large and confuses differences with game 4.
93. High demand in spring of 93 in Daily model compared to DWRSIM and historic – affects pumping rates. 500 TAF of export controls by extending VAMP to 6 weeks is a very large burden on EWA. Water could be made up during the summer unless demands are high.
94. Highly questionable taking on debt of 875TAF by June in San Luis by EWA.
95. Should consider shifting debt to Sacto reservoirs and shift SJ water in July.
96. Cost of debt moving could affect peaking power generation.

97. If Shasta or Oroville spill in winter then the debts taken on are erased. EWA borrowed water in San Luis was shifted to upstream reservoirs in previous summers are therefore erased with new filling.
98. By shifting X2 up or down we are either giving or taking project water.